PRINCIPLES OF EDUCATION

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TO MY STUDENTS

THIS BOOK IS AFFECTIONATELY DEDICATED

PREFACE

The present work is the outgrowth of actual class-room experience in teaching the subject for two years in the State Normal School at Milwaukee and eight years in the State University of Iowa. Previous to this experience, many of the ideas here expressed had been gradually shaping themselves while the author was teaching and supervising in public schools. All of the material has been carefully tested in junior and senior university classes, and much of it in advanced normal school classes. Portions of several chapters have been given many times in teachers' institutes and associations. The distinct aim, however, has been to produce a text-book of college grade for beginners in the study of educational science.

It is hoped that ten years of public school experience has given the book a practical flavor. No science or art is worthy of pursuit unless it has some relation—direct or indirect—to the every-day pursuits of life. The end of all science should be better and higher living. The science of education should contribute richly to the solution of the every-day problems of the teacher and the parent. This contribution should be in the form of underlying principles, rather than prescriptions and devices. The one who is seeking recipes for doing specific things will seek here in vain.

Parents and other citizens need an interpretation of life. A study of the principles underlying the great problems of education gives certain phases of interpretation in a singularly helpful way. I have been much encouraged by the numbers of students who have spontaneously spoken of the new interpretation of all their studies and of life which came through a study of the science of education. It is unfortunate that education and teaching have been regarded as synonymous terms. It is

hoped that this book may help to modify that notion. In reality, the study of educational principles, the function of education in society, and the history of education are important for lawyers, doctors, ministers, journalists, and parents, as well as for teachers. It is important that these phases of the study of education should come to be regarded as truly liberalizing as languages, literature, science, or mathematics.

During the last quarter of a century an unprecedented amount of attention has been devoted to the scientific study of educational problems. Much research and experimentation have been carried on and the results recorded largely in periodical literature. A rich and interesting literature of education has thus been accumulated. But very inadequate attempts have been made to gather the fruits of the old and the new into convenient hand-books. Consequently much valuable material has been practically inaccessible to beginning students, who are usually obliged to study in large classes. The author has felt keenly the handicap due to the lack of such manuals and hopes that this work may in some measure remove the difficulty which college teachers of education everywhere have recognized.

The chief claim made for this book is that it assembles the main, well-tested results of the scientific study of education from the psychological and biological view-points and presents them in a way which secures continuity, correlation, and a unified interpretation of them. It was originally planned to include a discussion of the sociological phases of education, but the magnitude of the task and the limits of the size of the book have prevented. It is not assumed that all of the possible or valuable principles of education are discussed in this book. Neither is it claimed that they are stated in the most critically logical order. From the stand-point of apperception and interest the order here given has seemed to be justified by experience. Doubtless the order of chapters may be varied considerably with equally satisfactory results. There has been no attempt at making a "comprehensive system" which should excite only the interest of the "logic chopper." It is believed

that every principle set forth is of such vital importance that its expression in a convenient hand-book will be welcomed. Additions and rearrangement will need to be made subsequently. It is hoped that this book will be regarded as a pioneer which may be useful in blazing a new trail into the land so full of promise.

The author's plan in the class-room has been to make the lectures very informal. In writing them out for a larger audience it is hoped that the informality has been to some extent retained. That will account in some measure for the size of the book. One great defect of pedagogical text-books heretofore has been their exceeding brevity and abstractness. They have contained summaries instead of substance. Such books prove unintelligible to beginners and unnecessary to advanced students. To teach well one must have an abundance of concrete details and illustrations. The first chapter is intended merely as an introduction and differs from all the rest in being necessarily abstract and condensed rather than concrete and expanded. The beginner should read it on first approaching the subject for the purpose of orientation rather than with the expectation of mastery. The broad generalizations can only be fully comprehended after various subjects treated in the subsequent chapters have been studied. The student is advised to reread the chapter after the rest of the book is mastered.

An attempt has been made to guide the reader to the rapidly growing literature of education. To this end direct quotations are frequently given and references appended. In this way the author has hoped also to give credit wherever due and to acquaint the reader with some of the many who are contributing so richly to the great work of education.

F. E. B.

Iowa City, Iowa,
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CHAPTER I

THE NEW INTERPRETATION OF EDUCATION

Popular View of Education.—Education is commonly measured by the number of years of schooling one has had, the institutions attended, the subjects pursued, degrees conferred, and by other similar conventional measuring units. One whose school training has been abbreviated, who has not been through the traditional mill and ground out according to a standard pattern, is often said to be uneducated. Even many scholarly people think of the science or the philosophy of education as dealing wholly with methods of teaching the various school subjects or with school management. While the subject of education may be properly concerned with principles underlying methods of instruction and management, it is by no means restricted to them. This popular conception of education as something confined to schools and school-rooms, the acquiring of book facts, formal drill and discipline, is altogether too narrow.

New Interpretation.—Education is not a new process, but it is receiving new interpretation. Many of the means of education are of very recent origin; but education is in reality a process as old as the race itself. Whatever influences one in such a way as to determine his future conduct is a means of education. This is true whether the influence comes from external forces or as a resultant of one's own actions. Education may thus be good or bad; may elevate or debase. The school, though conventionally regarded as the only institution of education, is of comparatively recent development. But

it is not the most fundamental means of education, even though society tends to relegate all educational functions to it. Reflection shows us that there are multitudes of influences which help to determine the character of every individual. A few of these factors will be considered.

The Home as an Educator.—First consideration may properly be given to the home. This is the first institution to touch the life of the individual, and in many ways it is the most influential of all the forces brought to bear upon him. Though the school and one's business or profession give more definite mastery of technical accomplishments which come to be regarded as the fruits of education, yet the use to which these will be put is largely determined by the ideals developed in the home. Religious creeds are gained at the mother's knee, political beliefs are absorbed in the family circle, and social ideals largely fixed by family customs. Honesty, veracity, politeness, good manners, clean living and temperance, are most easily inculcated in the home. Likewise, on the other hand, immorality and unrighteousness may be generally traced to undesirable home influences. In fact, the ideals which dominate life and character and give them significance owe more to home influences than to all others combined. So important is this early formative period that some of the churches say: "Give me the child for the first seven years, and the world may have him the rest of his life."

Institutional Influence.—Besides the home there are many specific institutions and activities that educate as really as do the schools. For the great mass they even provide the major portion of the training received. All forms of occupation furnish training and extension of one's horizon. Various scientific, historical and literary societies, clubs, lodges, labor organizations, and guilds, encourage the social instinct and give intellectual and moral uplift. Then there are special means employed to supplement the schools. Among these are lecture courses, public libraries, reading circles, chautauquas, and reading-rooms. The daily newspaper, the magazine, the

telephone, the telegraph, commercial intercourse, etc., all furnish knowledge and incentives for learning, and supply outlets for activities that contribute to the modification of the thoughts, taste, and conduct of the individual. Even plays, games, sports, and pastimes are of vast moment in the development of latent capabilities and in stimulating new ones. In determining a boy's moral action the neighborhood environment and the neighbors' boys are far more instrumental than the school.

President Butler says:[1] "The doctrine of evolution teaches us to look upon the world around us—our arts, our science, our literature, our institutions, and our religious life—as an integral part, indeed as the essential part of our environment; and it teaches us to look upon education as the plastic period of adapting and adjusting our self-active organism to this vast series of hereditary acquisitions." Dr. Harris[2] emphasizes the importance of the state in education, and maintains that indirectly it is the most influential of all. He writes: "The influence of the constitution of the state, and of its transactions with other states in peace and war, weaving the web of world history, is known to be more powerful in educating the individual and forming his character than any of the three phases of education mentioned (home, school, church), for it underlies them and makes possible whatever perfection they may have. Without the protection of the state no institution can flourish, nothing above savage or barbarous human life can be realized. . . . The state is the essential condition for history. . . . History commences with the evolution of man's substantial self and its realization or embodiment in a state."

Farm Life.—The duties and environment of the farm are often thought to be directly opposed to education. But well-ordered farm life offers the most advantageous sort of environment and discipline that childhood and youth could have. At its best, when made significant through books, good schooling,

[1] *Meaning of Education*, p. 13.
[2] *Psychologic Foundations of Education*. p. 266.

and the intelligent leadership of parents, it affords certain educative means that money cannot purchase in crowded cities. To be deprived of its advantages and pleasures is almost calamitous. The outdoor exercise and healthful recreations develop firm muscles and red blood, healthy brains, and vigorous constitutions, without which mental development can proceed only indifferently. The farm duties bring a sense of responsibility, so often lacking in city-bred children, and also secure motor training invaluable for all future accuracy of work and for will development. President G. Stanley Hall says: "Of all work-schools, a good farm is probably the best for motor development. This is due to its great variety of occupations, healthful conditions, and the incalculable phyletic re-enforcements from immemorial times. I have computed some threescore industries, as the census now classifies them, that were more or less generally known and practised sixty years ago in a little township which not only in this but in other respects has many features of an ideal educational environment for adolescent boys, combining as it does not only physical and industrial, but civil and religious elements in wise proportions and with pedagogic objectivity, and representing the ideal of such a state of intelligent citizen-voters as was contemplated by the framers of our Constitution." Because of its opportunities for immediate and prolonged contact with nature there is offered the best possible preliminary nourishment for the understanding and appreciation of science, literature, and art. Here is offered the chance to find "tongues in trees, books in the running brooks, sermons in stones, and good in everything."

The Playground.—The function of play as an educative factor is only just beginning to be realized. It is not long since play was very generally regarded by serious-minded people as sinful. We now know that through play the child not only gains necessary relaxation and invigoration, but the forms of play are instinctive expressions of the unfolding potentialities gained through race experience. Play not only retraces ancestral experiences, but anticipates future adult experiences.

To work properly in adult life there must be natural and abundant play in childhood. Bagehot wrote: "Man made the school, God made the playground. Before letters were invented or books, or governesses discovered, the neighbor's children, the outdoor life, the fists and the wrestling sinews, the old games (the oldest things in the world), the bare hill, the clear river,—these were education; and now, though Xenophon and sums become obsolete, these are and remain. Horses and marbles, the knot of boys beside the schoolboy fire, the hard blows given and the harder ones received,—these educate mankind."

Influence of Chance Environment.—Not only purposive influences educate, but also all chance environment. The slums educate as forcibly as do Grand Avenue, the church, and the school; a candidate for the penitentiary helps to educate our boys no less than does the Sunday-school teacher. Sometimes the chance and baneful education is more forceful than the designed and elevating. According to Spencer's definition the purpose of education is to prepare for complete living. This even is a conception of an ideal education. Dewey has defined the term in a much more fundamental sense by declaring that education is not solely a preparation for something in the future. It may include that, but there is something more basal. Education, he says, is life itself; and conversely life is education. Here is the only conception which is broad enough, even when we consider ideal education. According to this conception every individual becomes educated, in fact, none can escape it. Even the lower animals, as well as man, undergo education, for do not their experiences bias their future conduct?

Influence of Primitive Arts and Occupations.—Shall we not consider the stride from savagery to civilization as education? But through the long struggle there were no schools except the effective school of experience. In this struggle with the elements, with wild beasts, and with each other, were men not taught some things? Whenever one is taught anything or learns anything there is education. Were not primitive men

for long ages learning how to make implements for warfare, for the hunt, and the chase; learning to make fire, how to cook, and how to spin and weave; how to clothe themselves, provide shelter and protection; how to plough, plant, and harvest; how to cure disease and avoid pestilence; learning methods of transportation, barter, and exchange; learning how to dig, smelt, and fashion the ores; how to utilize the wind and water, and employ the simplest mechanical principles? And when learned were these things not taught? And have they not influenced profoundly the whole character of subsequent history?

We are prone to forget that the school of experience has been in session since the world began and there have been no vacations. Nature has not missed assigning a single lesson. The credits received for the training have been recorded with absolute fidelity. The education which man has received in this wise is incomparably greater and the results are much more enduring than the results of a few centuries of formal education since schools began. In cudgelling his brains for some new school arts which might interest and profit the children it would be well for the school-master to take a retrospective glance and pass in review the school arts which mother nature has employed. If he can discern anything which is related to getting a living, providing food, clothing, shelter, amusement, or advantages, there he will find an interesting and effective school instrument. Utility has been the watchword of nature; it should be the school-master's.

When considering the function of school training it is important to remember that the development and progress attained since the invention of systematic schooling might be represented by a dot, while that achieved in the pre-school period through the exercises gained in connection with the everyday occupations in providing food, shelter, clothing, protection, and recreation would have to be represented by a line of infinite length. If the educational values of industrial activities were correctly understood, we should utilize them far more than we now do in formal education instead of bringing forward something far

removed from the basal instincts of mankind. The school ought to be the most effective instrument of evolution, and should co-ordinate all means that have proved valuable in phylogenetic development instead of discarding them and using only the latest discovered means.

Bain wrote[1] that, "in the widest sense of the word man is *educated*, either for good or evil, by everything that he experiences from the cradle to the grave. But in the more limited and usual sense the term education is confined to the efforts made, of set purpose, to train men in a particular way—the efforts of the grown-up part of the community to inform the intellect and mould the character of the young; and more especially to the labors of professional educators or school-masters."

School an Interpreter of Experience.—The school should be the educational institution *par excellence*. It should be, and is coming to be, the institution which co-ordinates all the best educational processes of life and adds its own special forms. The school studies principles of life rather than mere mechanical modes of immediate use in gaining a livelihood or deriving momentary pleasure and happiness. It thus furnishes an interpretation of life and gives significance to all other modifying influences. It looks to the future more than to the immediate present. The school is the standard-bearer of the highest ideals of the present and of the past. Advanced forms of schools, also, seek to discover new truths and new ideals, and thus become not only guidons of established forms of conduct, but heralds of new ideals. Universities have been the greatest factors in advancing civilization that the world has ever known.

The Child the Centre.—But even after cataloguing all the ideals of education and all the institutions and agencies that have a modifying influence upon the individual during his life, we have considered education from only one side and that the least potent. Such a study is like a study of *Hamlet* with Hamlet left out. Modern educational inquiry has shifted the view-point to include not only ideals and agencies but the

[1] *Education as a Science*, p. 6.

central figure in the process—the child. Nature has been proceeding slowly, steadily, for eons in the production of the crowning product of evolution, and if we would educate wisely we must spell out at least the fundamentals of the secret. Though we may utilize artificial substitutes here and there, yet all must be in harmony with the almost indelible traditional ways found efficient in ages of experimentation. The modern educationist is admonished to go to nature, consider her ways and be wise. The latter part of the nineteenth century deserves lasting credit for centring the attention of educators upon the child instead of the curricula. Though not losing sight of ideals and means, yet an effort is made to understand these in relation to the developing being. The most suggestive history of education is not the history of man-devised practices and theories, but the history which nature has written in the human embryo, disclosing a long, circuitous march from the humblest beginnings to the present wonderful attainment. Every child comes into the world freighted with potentialities gathered laboriously during long past ages. These are so integrally woven that to devise inharmonious educational machinery which cramps or distorts is to produce monstrosities. This suggests that there is no fixity of powers. Evolution has not ceased. Where there is evolution there is plasticity. But the plasticity of the child is not that of a lump of clay, yielding, resisting, but passive when modified. Biological plasticity means in addition to mere modifiability that new lines of growth and development are possible. Through heredity there are strivings along old lines of growth, but with power for new growth. The education of the child is a problem of life, not of an inert lump of putty; a problem of biology, not of physics; a problem of kinetics, not of statics.

Hereditary Prepotentialities.—Donaldson, in his monumental work [1] says: "Education consists in modifications of the central nervous system. For this experience the cell elements are peculiarly fitted. They are plastic in the sense that their connections are not rigidly fixed, and they remember, or,

[1] *The Growth of the Brain*, p. 336.

to use a physiological expression, tend to repeat previous reactions. By virtue of these powers the cells can adjust themselves to new surroundings, and further learn to respond with great precision and celerity to such impulses as are familiar because important.

"In its size and development the central nervous system is precocious. Long before birth all the cells destined to compose it are already formed, though by no means all are developed in the sense that they have acquired the form and connections characteristic for those at maturity. At the close of embryonic life the sensory nerves rapidly extend, and the connection of the central cells with limiting surfaces of the body being thus established, all experiences become those of education. The act of living is thus the most important natural educational process with which the human body has to do, yet it is usual to restrict the term education to a series of formal events falling within the period of school life. . . . It appears probable that the education of the schools is but one, and that, too, rather an insignificant one, of many surrounding conditions influencing growth."

Heredity marks out in broad outlines the limits of the abilities of each individual. Formal educational processes will determine the extent to which latent possibilities are rendered kinetic, but it cannot create tendencies. For example, one devoid of genuine musical capacity cannot develop into a master any more than an oak shoot can develop into a pine, or a racing filly into a draught-horse. Mathematical power, linguistic capacity, or delicacy of touch which will give surgical skill, artistic imagination and execution, are inborn and not created through school training. Besides his physical inheritance of bodily form, size, appearance, his instincts, mental predispositions, and capacities, every child receives a social inheritance in the form of language, institutions, laws, customs, printed literature, and the results of scientific achievements, which at once put him a long way ahead in the march of civilization. Without them his physical heritage would be incapable of securing him much advancement.

In a word, the whole natural history of the individual has been operative in shaping his destiny. The given individual is the resultant of all forces acting upon the developing organisms from the time they began life as simple, one-celled congeners of an aqueous medium. By life is meant not only the individual's own life but all his ancestral life. One's education begins not only two hundred years before one is born, but eons before. A good share of the life of the given individual is a process of the unfolding of his potential capacities. Evolution has plainly taught us that in attempting to bring about any condition nature starts with what is, and utilizes the present conditions. To reform a criminal is a work of time, and all efforts toward that end must consider what his past has been. To reform a hardened criminal is a different proposition from rescuing juvenile offenders. In dealing with pupils in school, to lose sight of a boy's past life and his heredity is to fail completely to understand the means of further development. In attempting institutional reforms many failures result simply because unintelligent reformers attempt to graft alien measures upon stocks that are unrelated to them. An oak shoot cannot be grafted upon the apple-tree; neither can ideal social institutions be made to order; they must be the outgrowth of old conditions made to fit new times.

Many features of street life and even of home environment are out of harmony with all desirable educational ideals, and they cannot be utilized as agencies of ideal growth, but they must be considered and often combated. The farmer does not try to promote the growth of weeds, but he cannot ignore them. Much soil will not produce crops until the retarding agencies have been overcome or eradicated. Similarly in education, all native tendencies as well as environing conditions must be understood and reckoned with if wasteful methods are to be avoided. Education is concerned with the development of every desirable quality of body or mind which might be named. It is equally concerned with the suppression of every undesirable one.

Because of the necessity of understanding the past if we would build wisely for the future, all the great subjects of sociology, psychology, and education have come to be considered from the genetic or evolutionary point of view. If we would act wisely upon the individual mind or society we must take into account the present status and also the long, circuitous processes by which the present has been attained. We must note what factors have contributed to the growth of desirable qualities and what have eliminated undesirable ones. We must also know the hidden potentialities which only need the slightest encouragement to blossom forth in rich profusion, as well as those whose counteraction demand elimination or suppression before the germs of good may be quickened into life.

Education as Unfoldment and Adjustment.—Education is thus recognized as a manifold process of aiding the individual to come into full possession of all the desirable features of his heritage, to minimize the undesirable ones, and to initiate new tendencies. The child should be developed definitely in harmony with innate tendencies and toward the best ideals attained by the race. That is, both biological and social heredity are to be heeded. Education is consequently a process of development and of modification or adjustment to environment and to the ideals of perfection conceived by society and by the individual. It involves all the forces operating to mould the individual. These forces include natural environment, social environment, institutional environment, as well as the factors of food, clothing, climate, etc. The amœba has to adjust itself to a changing habitat. The freshman likewise has to adjust himself to the college surroundings, so different from his home village. Each is modified in the process, and successes or failures in life are measured by the power of adjustment to the new conditions.

"This period of adjustment," says Dr. Butler,[1] "constitutes, then, the period of education; and this period of adjustment must, as it seems to me, give us the basis for all educational

[1] *The Meaning of Education*, p. 15.

theory and all educational practice. It must be the point of departure in that theory and that practice, and it must at the same time provide us with our ideals. When we hear it sometimes said, 'All education must start from the child,' we must add, 'Yes, and lead into human civilization'; and when it is said on the other hand that all education must start from the traditional past, we must add, 'Yes, and be adapted to the child.'" Education thus viewed places weighty obligations upon each individual. Every person should become concerned for his own welfare and that of the race.

Ideal Education Seeks Human Perfection.—Attention has been drawn to these lower forms of influence which bias conduct, in order to assist in understanding the complexity of the problem of ideal education. The formal processes of education are designed to be applied to an individual for the purpose of developing, modifying, or moulding him in harmony with ideal conceptions of development. These ideals may be conceived by the individual himself or by others concerned in his education. The processes may be applied by the individual or by those interested in him. The highest results are not reached until the individual himself consciously strives toward ideal perfection.

The National Educational Association at its annual meeting in 1905, at Asbury Park, New Jersey, voiced its sentiments concerning the highest functions of education. As a part of its resolutions it was stated that "the Association regrets the revival in some quarters of the idea that the common school is the place for teaching nothing but reading, spelling, writing, and ciphering; and takes this occasion to declare that the ultimate object of popular education is to teach the children how to live righteously, healthily, and happily, and that to accomplish this object it is essential that every school inculcate the love of truth, justice, purity, and beauty through the study of biography, history, ethics, natural history, music, drawing, and manual arts. . . . Character is the real aim of the schools and the ultimate reason for the expenditure of millions for their mainte-

nance." The foregoing are statements of the highest aim of education. Attention is directed to them in this connection to suggest that most of these aims are equally well inculcated outside of formal school work.

Education Concerns Posterity.—Education is not a matter which concerns the individual alone, but also his posterity. The effects of the education of a given generation do not terminate with its death but are transmitted to succeeding ones. Through heredity the results of education are conserved for society. Not only are the sins of the fathers visited upon the children unto the third and fourth generations, but also the virtues of the fathers are manifest through hundreds of generations of them that love the Lord and keep His commandments. By his progress toward the ideals of the race each one should be a contributor to its desirable attainments and to higher ideals. One's education is relatively inefficient until he consciously strives to understand and approach perfection. Similarly education is at a low ebb where the majority of its individuals are not earnestly seeking higher development. Every individual should realize the far-reaching effects of every thought, every feeling, and every action. One who grasps the full significance of education in the light of evolution cannot fail to be more concerned for the welfare of his fellow men and for posterity. The faithful conservation of all the effects of righteousness accounts for race progress. Such a conception is a doctrine of altruism and of the highest optimism. It is hoped that this is reflected in all the succeeding pages.

Education and Evolution.—Viewed in this broad way, it is seen that education is an evolutionary process. Every situation in life tends to modify the individual and to produce new adjustments. The whole of life is educative. Not only do experiences even passively received produce modifications, but on the part of all life there is a striving toward new conditions. This is true of life from the simplest amœba to the grandest work of nature. These new conditions are the ideals. The multitude think of evolution as operative in the production of

plant and animal forms, and generally as a force of the long-gone past, but evolution did not cease with the crayfish. It is going on all about us at a rate never before equalled or appreciated. The most mighty evolutionary force is that of the conscious education of human society. The function of education narrowly conceived stops with the training of individuals, but the ultimate object is not an individual, or even individuals, but society. The true educator must be concerned not only with adjusting John and Mary to particular niches in life, but he must look to the development of higher ideals for the whole human race and the conscious striving for and attainment of these ideals. Each individual should feel his obligation to leave society better than he found it. Because he stands on the shoulders of the past he is responsible and unworthy the "Well done, thou good and faithful servant," unless the world is the beneficiary through his having lived in it.

Several recent writers, prominent among them Spencer, Fiske, Butler, and O'Shea, have emphasized the idea of education as a process of adjustment. They would not have us infer that the adjustment is an expedient of adaptation to unavoidable conditions of environment. In its higher phases it would certainly involve the adjustment of the individual to the best ideals conceived by the race. Definite educational means seek to realize these very aims.

Since education is as broad as life itself, the biological view will be made prominent throughout this book. The intimate relations between mind and body and the correlation between their functions make it imperative to give due consideration to certain physiological aspects of educational processes. But the superlative problem of every educator is to influence the *mind*, to produce modifications of intellectual, emotional, and volitional life. Hence a thorough knowledge of mind and its means of development should be the highest concern of every educator. In subsequent chapters the psychological aspects of education will therefore occupy a relatively large space. While no special section is set apart for a consideration of the social phases of

education, at every step the effect of society in shaping the individual consciousness is recognized. Likewise, while no separate treatment is devoted to educational ideals, yet a discussion of this phase of the subject is interspersed throughout the book.

CHAPTER II

ADAPTATION, ADJUSTMENT, AND SPECIALIZATION OF FUNCTIONS

General Considerations.—The previous chapter has prepared the way for a wider conception of education than that generally held by the popular mind. Most definitions of education characterize it as a preparatory stage for something yet to come. This is the truth, but not the whole truth. Spencer was right in regarding education as a preparation for complete living, but Dewey has furnished a desirable supplement by showing that all life processes and activities are a vital part of education. Consequently while we properly regard the formal, artificial educational processes as preparation for adult life, let us not forget that the very maintenance of an existence is a schooling more rigorous and influential than any artificial exercises we may interpose.

Since all of life's experiences are contributory factors, whether we will or no, we must then include in our educational philosophy not only mental, moral, and even physical education, but we must make our consideration cover a field as broad as life itself. Biology, the science of life, is not confined, as many seem to suppose, to worms, insects, beetles, and algæ; but includes man as well—not only physical but psychical and moral man. It is perfectly proper to speak of the biological consideration of memory, imagination, instinct, the emotions, love of right, etc. They all have their genetic or developmental aspect. In dealing with these, even in a practical way in the school-room, we ought to know how they differ in children and adults, in different families, in different children, in different races, their laws of growth and development, their instinctive beginnings, and their

hereditary variations. Consequently this and several succeeding chapters will deal with the biological phases of education.

With these preliminary remarks and with the admonition to keep constantly in mind that experience and education, fundamentally considered, are one and the same thing, we shall enter upon the discussion of some concrete facts showing how adjustment of various organs, organisms, and functions to ever-varying conditions has produced modified organs, organisms, and functions, in harmony with the demands of new environments. Illustrations will be drawn from lower animal life and even from the plant world to exemplify the points under consideration. Similar processes though often infinitely more complex, affect man's progress and destiny and constitute the essential features of education.

Adaptation in Unicellular Animals.—Without varied environment and consequent varied experiences, development, progress, education in the best sense could not be. In the first chapter it was shown that anything is educative which acts upon individuals or a species so as to mould them to new ways or to bias their future conduct. The resultant tendencies constitute the education received. With this idea more firmly in mind, let us consider the unicellular animals in their relation to environment, and study in them a most primitive educational experience. These little creatures can exist only under tolerably uniform conditions. A slight increase or decrease of heat means destruction to them. Their aqueous environment is a relatively simple, uniform, and unchanging medium in which to exist. They have little to learn to fit them for this environment. It is probable that they have been little modified through long ages. President Jordan says, "That the character of the body structure of the Protozoa has changed but little since early geologic times is explained by the even, unchanging character of their surroundings. The oceans of former ages have undoubtedly been essentially like the oceans of to-day—not in extent and position, but in their character of place of habitation for ani-

mals. The environment is so simple and uniform that there is little demand for diversity of habits and consequent diversity of body structure. Where life is easy there is no necessity for complex structure or complicated habits of living."[1] But even here we find individual and race adaptations and modifications which permanently influence all subsequent actions. That is, these minute animals are in that sense educated.

Experiments in Adaptation.—Lloyd Morgan records[2] the results of experiments by Dr. Dallinger to determine whether monads could gradually become acclimatized to a temperature higher than 60° Fahr., that which is normal to them. By the end of four months the temperature had been raised to 70° without destroying them. On reaching 73° adverse conditions were observed. A rest of two months was made at this point, and then the gradual increase resumed. In five months 78° was reached. "By a series of advances, with periods of rest between, a temperature of 158° Fahr. was reached. It was estimated that the research extended over half a million generations. Here then, these monads became gradually acclimatized to a temperature more than double that to which their ancestors had been accustomed—a temperature which brought rapid death to their unmodified relatives."

Although allowing for elimination of the unfit, Morgan says: "But in any case, the fact remains that the survivors had, in half a million generations, acquired a power of existing at a temperature to which no individual in its single life could become acclimatized. Here, then, we have the hereditary transmission of a faculty." Here we have an illustration of the permanent modification—education—of a species through experience. These processes of adjustment of the individual to environment constitute the most primitive type of education. This is true of all the lower animals as well as of man.

Effects of Experience.—There is a constant struggle on the part of each animal to master its surroundings and to put itself into harmonious relation with them as it understands them.

[1] *Animal Life*, p. 23. [2] *Animal Life and Intelligence*, p. 147.

Each experience produces a modification of form, structure, or function, either physical or psychical, and the modification becomes a permanent possession, producing predispositions which tend to bias all future action. This means that the animal profits by experience. The process of learning by experience is education. Thus we see that all organisms receive education. It may not be according to our ideals, but there is education nevertheless. Not only man, but the lowly earthworm and the amœba receive it. Not only does the individual gain an education, but through heredity the species is made a sharer and a contributor.

In the effort toward adjustment there is always an accentuation of some function or organ. For example, in the effort to capture a certain kind of food certain organs or sets of muscles are brought into new use, or, as in the case of man, when mere muscular power no longer suffices he uses his wits to effect a capture. In the former case the muscles that underwent extra exercise became specially developed; in the latter the mental powers performed the extra work and were developed accordingly. Thus specialization has taken place because it has been advantageous. In fact, we may say, to paraphrase Spencer's cosmological formula, that the whole course of life development, that is, education, has been a process of change from that which is relatively simple, homogeneous, undifferentiated, unspecialized, to that which is complex, heterogeneous, and specialized. This is as true of society as of animal structure.

"With the increase in degree of the division of labor among various parts of the body, there is an increase in definiteness and extent of differentiation of structure. Each part or organ of the body becomes more modified and better fitted to perform its own special function. A peculiar structural condition of any part of the body, or of the whole body of any animal, is not to be looked on as a freak of nature, or as a wonder or marvel. Such a structure has a significance which may be sought for. The unusual structural condition is associated with some special

habit or manner of performance of a function. Function and structure are always associated in nature, and should always be associated in our study of nature." [1]

Necessity for exercise in a particular direction has either produced variations or accentuated them. These modifications have been preserved through heredity. This is the history of evolution, of progress, of education. While each individual tends to vary in some direction or other, heredity tends to conserve with great jealousy everything gained. In this there is not complete success, for we find in some cases a loss of function and structure.

Illustrations of Nature's Adaptations.—Among both plants and animals it is easy to cite a sufficient number of cases to demonstrate fully that the processes of adjustment to environing conditions are continually taking place. Not only are new species evolved in this way, but organisms selected from a given generation and placed under changed conditions become very materially different from the specimens that remain under usual conditions. For example, if either plants or animals are removed from a terrestrial life to aquatic conditions, or from fresh to salt water, and succeed in adapting themselves to the new conditions, they undergo changes of external aspect, internal structure, and other modifications. A few illustrations are subjoined to make the point clear. De Moor says [2] the leaves of the water Ranunculus with laciniated leaves are of normal structure when grown on dry land. The epidermis is furnished with stomata and the constituent cells contain no chlorophyll. But when grown in water the leaves are much longer, have no stomata, and the epidermic cells are full of chlorophyll. Again, upon the authority of Goebel, De Moor says that cacti show remarkable adaptation to varying conditions. The Phyllocactus when grown in the light has a smooth stem, but when grown in the dark it becomes prismatic and thorny. The cactus and all the odd desert flora are doubtless the result of ages of struggle with peculiar climatic conditions. The cacti and each one of the other peculiar

[1] Jordan, *Animals*, p. 77.

[2] *Evolution by Atrophy*, p. 26.

guardians of the lonely waste had an ancestry quite unlike the present inhabitants. The edible mussel has one kind of shell if grown in shallow water, another if grown in deep water, and yet another if it lives in salt water. Shells vary in color according to the latitude and the depth of the water. We know that domestication produces changes in every species. It is seldom that a wild species when kept captive will breed. Darwin says:[1] "Nothing is more easy than to tame an animal, and few things more difficult than to get it to breed freely under confinement." This is often true of plants as well as animals. The ancestor of the horse was a clumsy, five-toed animal that lived in swamps. But through a process of adjustment to new conditions necessitating flight as a means of preservation it lost first the great toe, then the fifth, and next the second and third, and now only one toe ever develops to functional maturity. The others assert themselves in embryonic stages, but so feebly as to give way entirely to the single toe, the only one which could now be of any use. The cloven hoofs with the "dew-claws" tell the tale of a process that did not continue to the same extent; but the record of adaptation is there, plain to him who understands evolutionary processes. We need but to ask a "show of hands" to secure ample corroboration of the story of adaptation to environment. We can get the whole series from the fins of the fish, the hand of the frog, the wing of a bat, the arboreal hand with the peculiar thumb of the ape, clear to the beautiful hand of man with its infinite potentialities.

Adaptation through Artificial Selection.—English races of dogs, according to Darwin,[2] degenerate in a few generations and entirely lose their peculiarities of form and mental characters which formerly marked them off from all other breeds. Eimer showed,[3] as early as 1872, through his study of the variability of the wall-lizard, that changes took place so rapidly that it 'might be with equal justice described as species or variety, so much does it differ from the original form. . . . An instance is afforded in

[1] *Origin of Species*, p. 8.
[2] *Domestication*, vol. I, p. 37.
[3] *Organic Evolution*, p. 3.

this animal of undoubted natural race-production, which has evidently occurred in a relatively short period of time."

It has been demonstrated that plants transplanted from plains to mountainous districts soon become accustomed to develop in a shorter period of time and at a lower temperature. The same thing is shown in taking grains grown in southern latitudes to more northern ones. They rapidly adapt themselves to the new conditions, maturing in a considerably shorter period of time. Corn (maize) has been carried farther and farther north, and now large crops are raised in latitudes where it was formerly deemed absolutely impossible to cultivate it. That the changes are real and permanent is shown by the fact that if taken to the former habitat they have to become readjusted to that locality. Similar changes are being effected in the production of fruits. The great differences between domesticated plants and animals and their wild ancestors are so striking as to be discernible by all. These changes have all been effected in remarkably short periods of time. Among animals the psychic modifications are no less marked than the structural. Scientific agriculture, horticulture, and animal breeding are all demonstrating beyond doubt that new varieties and species can be produced at will and in incredibly short periods of time. The development of these new varieties and species is due to use and disuse. Characters which give advantageous adaptations are increasingly exercised and consequently developed; those which are disadvantageous fall into disuse and therefore tend to atrophy or degenerate. My reply to an anticipated objection that natural selection is the cause of all variations will be in the words of Harris in summarizing the work of De Vries that natural selection may explain the *survival* of the fittest, but it cannot explain the *arrival* of the fittest.

New Species through Adaptations.—De Vries maintains that the production of new species is nothing unusual. He also contends that the process of development of new species is not so slow as to elude observation. More startling still, he maintains that sudden mutations resulting in new species are the natural

and usual processes. His whole book, *Species and Varieties: Their Origin by Mutation*, is a professed attempt "to prove that sudden mutation is the normal way in which nature produces new species and varieties. These mutations are more readily accessible to observation and experiment than the slow and gradual changes surmised by Wallace and his followers, which are entirely beyond our present and future experience" (p. 30). In another place he observes that "in horticulture, new varieties, both retrograde and ever sporting, are known to occur almost yearly."

Variation and Specialization in Nature.—Species and individuals develop in special ways according to their own particular needs. In making the examination, let us keep in mind the pedagogical question whether uniformity among individual men is a prime consideration, or whether a great deal of variety is not a law of evolution and progress.

Oftentimes different animals on the same general scale both physically and mentally, exhibit very different characteristics in some direction or other. Their success in life has been due to the possession of their peculiar development. Variations in function and structure in nature came about through the necessity for adaptation to conditions. Food-getting, self-protection, rivalry, defence of young, and accommodation to surroundings include most of the causes for adaptation in nature. A few illustrations will be given to show how special modifications are continually taking place. The native English sheep have developed a long wool to protect them in a cool, damp climate. The giraffe's curious long neck is a result of continued high-reaching for food in a country where this was to be found mainly in trees. The different varieties of birds each have bills and claws especially adapted to their methods of food-getting. A stork with duck's legs and a hawk's bill would have a sorry time getting food under natural conditions, as would an eagle with stork's legs and crane's bill. Insect-eating animals have peculiar structures enabling them to secure food. The ant-eater is a good example. Insects' mandibles are wonderful instruments

illustrating the adaptation of means to ends. The curious forms and structures of fishes are interesting illustrations of the same relation. Some can fly, others have swords, and there are those with spines that vanquish enemies; some have eyes on the side of the head, others on top, and still others are blind. The great variety of habits manifested by different animals have all been accumulated through long practice of certain activities necessitated by surroundings. Bats and owls are nocturnal, and bears and most insects hibernate through the winter. Some animals are solitary, others social. The opossum has learned to simulate death, and the partridge practises deception in feigning a broken wing in order to lead enemies away from her brood. Through adaptation degeneration frequently occurs. This is true of cave animals. Certain insects that inhabit islands have lost their wings because flying insects are in danger of being carried out to sea. Protective coloration and mimicry afford striking examples of the laws of adaptation. "In general," says Jordan,[1] "all the peculiarities of animal structure find their explanation in some need of adaptation."[2]

Human Adaptations.—(*a*) Anthropological. We need scarcely more than mention the myriads of human adaptations that have occurred, some of them through the necessities imposed by chance conditions, others, as in the higher social and ethical life, designedly wrought in the attempt to realize higher ideals which we have formed. The historians have long since noted and emphasized the far-reaching importance of climate and geographic surroundings upon the development of peoples. The mountains and coast-lines of Greece, the seven hills of Rome, the arctic winter and intolerable nights of Greenland, the torrid sun and sweltering heat of Africa, and the fertile fields of America have formed the texts for many a chapter designed to show the effect of environment in shaping destinies. Reverse the sur-

[1] *Animals*, p. 147.

[2] Those who wish to follow out the varied data should consult works like those of Darwin, Huxley, Cope, Brooks, and Romanes. The section on Recapitulation recounts more particularly the evidence of man's line of development which has been established through the sciences of embryology and paleontology.

roundings of the Eskimo and the New Englander, the Briton and the Abyssinian, and what inversions of character might have ensued. Indeed we may say that the chance environment surrounding one's birthplace to a large extent determines whether one is to be a dreamer or a doer, an idler or a producer, a savage or a progressive citizen. In fact, a few weeks only of a particular environment at a critical time frequently decides whether one will become an upright citizen or a perverted sinner.

As will be shown more fully in the discussion of heredity, only slight modifications of physical and mental characters can be produced in a single generation. Heredity is a great conservative force. In sociology natural selection plays only a secondary rôle, while artificial selection is the dominant factor. The real problem of higher human education is to discover a desirable ideal life for each individual and then to shape his environment so as to contribute best to development in harmony with that ideal. This should not be a matter of chance, but a work demanding the brightest intelligence and highest wisdom.

Human Adaptations.—(*b*) Biological. The first weeks of life of all human beings and their entire ante-natal existence offer a close parallelism to the adaptations accomplished by lower organisms. The conditions of existence must be tolerably uniform or extinction is the penalty. That the babe is at first powerless to acquire any great range of activities or much dexterity is well known. Microcephalous and other idiotic children always remain in bondage to a circumscribed range of life and are powerless to initiate new things or to acquire them if instructed. It will readily be granted that it is a long stride between education of this sort and post-graduate university education, but the difference is one of degree. The processes are similar.

In childhood, and in fact throughout life, the main adaptations, as is true of the protozoans, are concerned with the every-day problems of existence. As in the case of the micro-organisms, the human being learns to avoid or inhibit that which is harmful or disadvantageous, to repeat that which is pleasurable or bene-

ficial. Thus many activities become stereotyped and largely a matter of routine. Not only does an individual follow grooves which have been established by experience—by education—but the same is true of the race. Instinct, as will be explained more fully later, is simply a race habit, or the standardized results of race education. The individual and the race virtually become "repeaters." This is not the whole of education. To progress much there must be independence of thought, initiative, inhibition, resistance, deliberation, voluntary variation from stereotyped action. But all of these higher depend upon the lower, and, as will be shown, are even more efficient when the lower are best developed. In fact, it must not be forgotten that conservation is equally as important in life as are variations. It is even as important for progress. The frog which climbs out of the well ever so fast makes no progress if he slips back with equal rapidity and regularity.

The School-master Should Imitate Nature.—It is a part of nature's great plan to fix immediately every advantageous acquisition. The successful school-master must again consider her ways and be wise. All learning must be put into some vital relation to the every-day thoughts and actions of life, otherwise the child is ever acquiring but never conserving. Nature builds absolutely sure foundations by fixing "for keeps" everything acquired that is worth while. In our hot-house educational methods our tendency is forever to sample new things and never grow a single process into the texture of muscles, brains, and minds. At the close of such an education the individual is as limp as a squash vine—possesses no real fibre physically, mentally, or morally. This is especially true of much present-day moral and intellectual education. Intellectual and moral truths are learned, not to be put into effective relations, but to be given a mere kaleidoscopic exhibition on examination day. Obsolete arithmetic problems are learned for the examinations, not for their every-day value; children babble a catalogue of the bones, but fail to learn and practise a single, real, hygienic principle like deep breathing or temperate eating. They tattle proverbs, mum-

ble words of morality, sing hymns—even say prayers—in a perfunctory way with no thought of the application to their own lives. Such teaching cannot produce the results we claim for education. Formal educative acquisitions should become integrated with every thought, every feeling, and every proposed action of our every-day existence in exactly the same manner as the racial educational experiences have become integrated. Otherwise they disappear like the dew before the morning sun, and there persist only the oft-repeated, manifoldly related impressions and processes that are gained through the school of experience. Every impulse is a resultant of thousands of experiences repeated in manifold variations.

CHAPTER III

DEVELOPMENT AND SPECIALIZATION OF THE NERVOUS SYSTEM AND THE SIGNIFICANCE FOR EDUCATION

Beginnings of Self-Activity and Sensitivity.—Among inanimate substances like the rocks, minerals, water, and the clod of earth, we observe no evidences of sensitivity or of active response to the influences of environment. To be sure, chemical changes take place, but the substances are apparently inert and passive unless brought into contact with other substances for which they have affinities.

But in the plant world we observe a very definite reaction to certain stimuli. In the spring, under the influence of heat, light, and moisture, plants put forth buds, leaves, and shoots; the sap circulates, and they increase in size, extend their roots, develop blossoms and finally fruit. Although outside conditions must be favorable, yet we notice that the plants of their own energy attack the surrounding atmosphere and the soil and appropriate what is necessary for their growth. So great is the energy put forth that small roots work their way through large pieces of wood, pierce crevices of the rocks, and sometimes even rend stone walls. Fruits like the pumpkin, when harnessed, will lift hundreds of pounds, and delicate plants will under certain conditions lift many times their own weight. Dr. Harris [1] writes: "One may admit that the environment acts on the plant, but he must contend for the essential fact that the plant reacts on its environment, meeting and modifying external influences." That plants turn toward the light or bend in certain ways is not because of any purposive force within the plant, but

[1] *Psychologic Foundations of Education*, p. 27.

merely because of heliotropism or geotropism. There are only a few cases in which plants seem to exhibit sensitivity, powers of locomotion, and definite reaction in securing some end. The sensitive plant and the Venus fly-trap seem to respond to touch by certain movements. In spirogyra the process of conjugation seems to be accompanied by purposive movements on the part of the plant cell. But it is quite possible that these cases are also merely tropisms of some sort brought about by outside forces.

No Nervous System in Plants.—Although plants manifest such definite evidence of self-activity and even crude sensitivity and power of response, yet there is no evidence of that wonderful mechanism—the nervous system. Not only is the nervous system lacking, but biologists do not generally concede the possession of nervous tissue. But if there is sensitivity and power of response even in the slightest degree, does this not suggest, at any rate, some substance capable of receiving stimuli and transmitting impulses?

Homogeneity in Protozoans: Educational Suggestions.—Not even all animals possess a system of nervous mechanisms. Protozoans, of which the classical little amœba (see Fig. 1) is a good representative, are practically undifferentiated in structure. The amœba is composed of a cell-wall enclosing a body of almost homogeneous protoplasm. Occasionally a few granules whose structure and function are unknown are present. This little animal possesses the powers of digestion, respiration, a certain crude sensitivity, and locomotion. In a certain sense it remembers, imitates, and learns. All of these functions are carried on by means of the single undifferentiated cell. In other words, a single homogeneous organ performs several functions, performing each as well as any other, no one in a superior manner, but all most crudely. In education we have

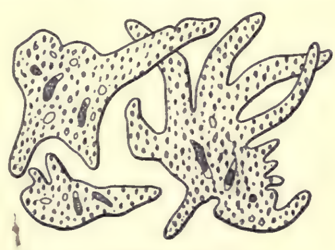

FIG. 1.—*Amœba princeps*, x 150. The same animal in various shapes. (From Orton.)

heard much of "all-round" training. Verily, here is an example *par excellence* of an "all-round" individual. When the amœba is affected by a stimulus—light, for example—it is not necessary that any particular portion be stimulated, for the whole body is equally sensitive. When it reacts, it does so not with a hand, a foot, a lip, a tongue, but with the entire body. It may contract one portion of its body, but it expands in another. In what direction it will move, or what part of its body will move most, is unpredictable. Just as it has no eye to be stimulated by light waves, no ear to be affected by sound waves, no special organs of touch or temperature, it does not react with a definite portion of the body and in a particular direction. A man feeling too strong a light would move his chair, pull down a curtain, turn away, or ask some one to change the conditions. That is, he would do a definite thing and bring special organs to bear in accomplishing the result. He would *co-ordinate* stimuli with means and modes of reacting and accomplishing definite ends.

Primitive Nervous Structure.—The amœba possesses no nervous *system*. Zoologists have usually said that it possesses no nervous substance. But its sensitivity seems to point toward the possession of something akin to nervous material. The generalization that "there is no psychosis without neurosis" assumes that every sensitive organism must possess some nervous substance which through the action of stimuli gives rise to "neuroses," the concomitants of "psychoses." In some respects the animal possessing sensitivity is different from the plant, devoid of that quality. But the protozoans possess no system of nervous structure. Consequently, when the amœba is affected by outside stimuli the nervous energy generated is *diffused*, instead of being confined to special tracts. Some of the higher protozoans, such as the slipper animalcule (paramœcium) and the bell animalcule (vorticella), are somewhat more differentiated in structure and in function, but in none of the protozoans do we find anything approaching a nervous system.

The Elementary Structure and Function of a Nervous System.—The purpose of the nervous system and the sense organs is

to enable the individual to gain a knowledge of the outside world through stimulation and to respond in some manner to those stimulations. The sense organs are in part, as in the retina, merely specialized portions of the nervous tissue. In part they are specialized portions of the skin so sensitized as to receive certain stimuli from the outside world. These stimuli are transformed into nervous impulses by means of the nervous system. These nervous impulses in turn become the antecedents of muscular activity and in some cases the concomitants of mental processes.

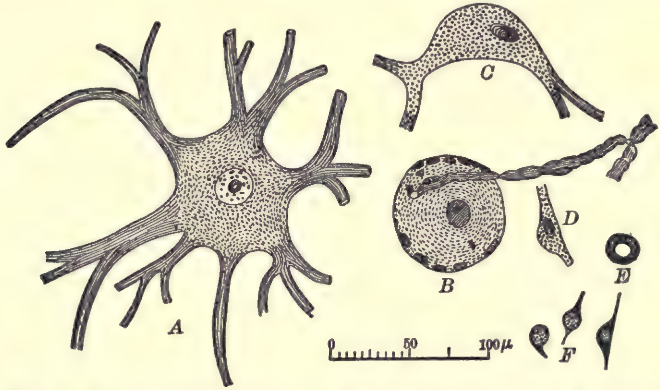

FIG. 2.—A group of human nerve cells drawn to scale, × 200 diameters. *A, B, C, D, F,* cell bodies and the beginnings of the processes; *E,* cross section of a large nerve fibre. (From Donaldson's *Growth of the Brain,* p. 142, modified from Waller's *Human Physiology.*)

The fundamental elements which compose the nervous system are the neurons (Figs. 2, 3). The neurons consist of a cell body with short branching processes, the dendrites, and an axis cylinder or axon. Branching off from the axon are usually many fibrils, termed collaterals. Neurons vary greatly in size, from the minutest microscopic dimensions to three feet in length. The different neurons are not anatomically continuous, but communicate by mechanical contact only. If the neural substance of the nervous system could be entirely freed from the connective tissue and blood vessels and be much magnified, it would present a distinctly fibrous or fibrillar appearance, rather than the jelly-like appearance so familiar in

the macroscopic view. This fibrous mass comprises many bundles of fibres and other organized pathways for the discharge of nervous energy. The muscles and their connections with the neurons complete the specialized equipment whereby we are enabled to react upon our environment.

The whole arrangement is admirably adapted for the special functions of a nervous system, viz., the liberation of nervous

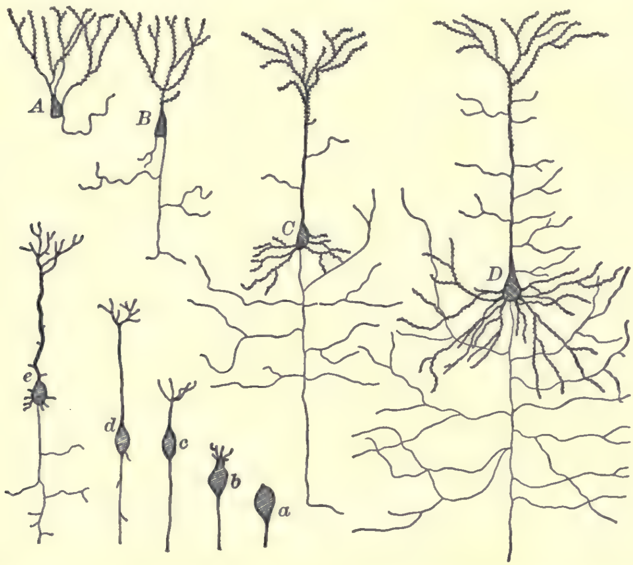

FIG. 3.

A–D, showing the phylogenetic development of mature cerebral cells in a series of vertebrates: *a–e*, the ontogenetic development of growing cerebral cells in a typical mammal. *A*, frog; *B*, lizard; *C*, rat; *D*, man; *a*, neuroblast without dendrons; *b*, *c*, developing dendrons; *d* and *e*, appearance of collaterals. (From Donaldson, *op. cit.*, p. 146; from S. Ramón y Cajal.)

energy and the conduction of nervous impulses. To live a complex life, to be highly educated, multitudes of co-ordinations must be established between stimuli and reactions. This function the nervous system is wonderfully fitted to fulfil. Without some such mechanism, complex adjustments would be impossible.

The Reflex Arc.—The simplest sensory-neuro-muscular mechanism enabling an animal to gain definite impressions of the external world and to react in a somewhat definite manner, is

the reflex arc. This consists of (1) a specially sensitized surface or end organ, (2) a sensory neuron connected with the end organ, (3) a motor neuron, and (4) a muscle connected with the motor neuron.[1] The accompanying diagram (Fig. 4) represents schematically the simplest reflex arc in the human spinal cord.

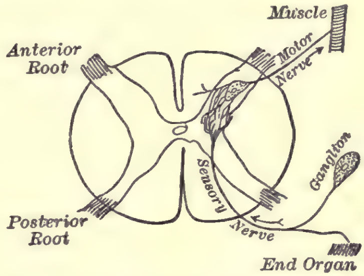

FIG. 4.—Schematic representation of the reflex arc.

Beginnings of Differentiation and Organization.—Among the radiata, including the echimoderms and cœlenterates, we observe much more specialization in general structure, and also the beginnings of a quite different nervous organization. The starfish may be taken as an example (see Fig. 5). There is a ganglion at the base of each radiating arm, connected with the œsophageal ring. A branch extends from each ganglion along each arm. The starfish possessing the beginnings of a nervous system, when stimulated, can react definitely with a particular portion of the body. Some recent experiments upon the starfish show that it can even be trained to move a particular ray upon the application of a particular stimulus. Nervous energy is directed along a particular channel and there is co-ordination of means and ends. This relation is only possible with a nervous system. The brain is the organ *par excellence* for co-ordinating functions. The medusæ possess a radiate structure similar to the starfishes, but no approach toward a central nervous organization. They possess several

FIG. 5.—Nervous system of a starfish.

r, nervous ring around mouth; *n*, radial nerves to each arm, ending in the eye. (From Le Conte.)

[1] See Howell's *Text-Book of Physiology*, p. 143.

nerve cords, but they do not meet one another in a common centre of radiation. "It is difficult to see," writes Le Conte, "how such an animal can have a common consciousness," meaning thereby that co-ordinated action of all parts toward a common end could not be effected.

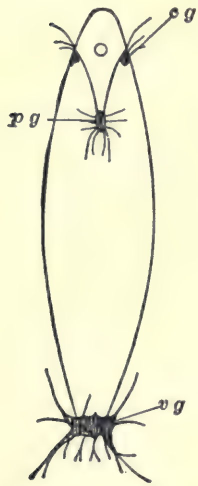

FIG. 6.—Nervous system of a clam.
cg, cephalic ganglion; *pg*, pedal ganglion; *vg*, visceral ganglion. (From Le Conte.)

The mol usca present an increasingly complex organization in general and more varied and definite functions, and we find here a nervous system of increasing complexity. New parts requiring to be moved are to be found. This necessitates new ganglionic centres. In the acephalous mollusca, typified by the clam and the oyster (Figs. 6, 7), although there is no well-defined head, yet one part is distinctly the anterior portion and another the posterior. Corresponding to this distinct advance over the radiates, there are two anterior ganglia on each side of the mouth. These are connected and also communicate with the posterior ganglion by means of two long lateral nerve fibres. In some cases, as in the clam, there is a ganglion in the organs of locomotion, called the pedal ganglion.

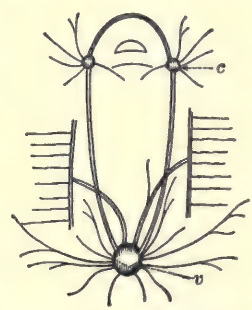

FIG. 7.—Nervous system of an oyster.
c, cephalic ganglion; *v*, visceral ganglion. (After Le Conte.)

The gasteropods (snails, etc., Fig. 8) and the cephalopods (cuttle-fish, squids, etc.) possess in addition distinct cephalic ganglia. These classes of animals possess much more perfect organs of locomotion and also have some well-developed sense organs, especially eyes. The articulates, including the worms, insects, etc., have a nervous system peculiarly adapted to their general structure and their activities. The locomotor apparatus is highly developed and the nervous

mechanism is largely subservient to this function. In general there is a chain of ganglia, one double ganglion for each segment. Branching off from this ganglion are small thread-like nerves. There is definite cephalization, but doubtless the cephalic ganglia may be regarded mainly as optic ganglia, for the eye is well developed in large numbers of the series. They also control the special organs of touch, the antennæ. In addition these lobes seem to be the seat of the other senses, which are beginning to make their appearance.

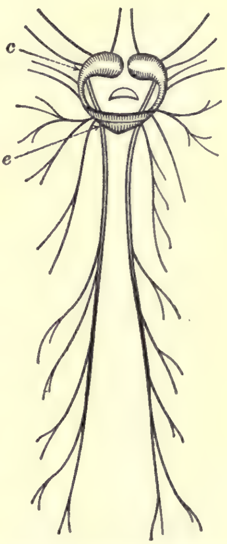

FIG. 8.—Nervous system of a snail.

c, cephalic ganglion; *e*, œsophageal ganglion. (From Le Conte.)

Nervous and Mental Correlations.—Among the higher articulates, the arthropoda, which comprise the crustacea (Fig. 9), arachnida, myriapods, spiders, and insects, we find examples of a high degree of intelligence. Ants, bees, and wasps, for example, through the entertaining accounts of their great sagacity by Lubbock and Romanes, have become classical animals. Peckham has also shown that spiders are endowed with intellectual powers far in advance of what is generally known of them. The senses of sight and touch are exceedingly well developed, and in many the sense of smell. Ants are said to track each other, like dogs, by the scent. They display considerable power of memory in the way they recognize friends long separated, the way they find their homes after long absences, and in the way they learn to profit by experience. Lubbock ascribes to them the emotions of sympathy and affection and speaks of their valor, rapacity, and pugnacity. They are known to keep slaves, to have cows or aphides; they are able to communicate their ideas to each other, and are said to be given a course of education. Romanes writes: "It is led about the nest, and trained to a knowledge of domestic duties, especially in the case of the larvæ. Later on

the young are taught to distinguish between friends and foes. When an ant's nest is attacked by foreign ants, the young ones never join in the fight, but confine themselves to removing the pupæ." This, he claims, has been shown by Forel and Mott to be instinctive.[1] They have their wars, are said to have play periods, indulging in games as well as in work, and they have harvest times.

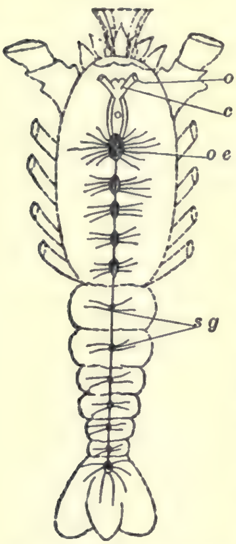

FIG. 9.—Nervous system of a crayfish.

c, cephalic ganglion; *o*, optic nerve; *oe*, œsophageal ganglion; *sg*, spinal ganglia. (From Le Conte.)

In the articulated series of animals the nervous development shows a nice adjustment between the needs and habits of the animals and nervous structure. Their mode of life demands a highly developed locomotor apparatus and we notice the separate ganglion for each segment, which in turn usually supports a pair of legs or some special means of locomotion. Thus each segment is practically independent, though controlled in a general way by the cephalic ganglia.

According to Carpenter practically the whole existence of invertebrated animals is reflex and instinctive. The arrangement of their nervous systems is well adapted to this. If we make exception of ants, bees, and wasps, and possibly some spiders, doubtless his characterization is correct. They learn very little by individual experience. Knowing the life history of the species, we may predict with much certainty the actions of the individual.

Vertebrate Nervous Systems.—When we pass to the vertebrates we find a much more highly specialized and real *system* of nervous organization. All vertebrates possess an axial and a ganglionic system. The axial system consists of a continuous tract of gray matter surrounded by white matter and lies along the dorsal side of the body. This tubular mass is enlarged at the

[1] *Animal Intelligence*, p. 59.

anterior end into a brain and gives off varying numbers of pairs of nerves along the whole length.[1] These numbers vary from about twenty in frogs, and forty-three in man, to a couple of hundred in sawfishes. In the amphioxus, or lancelet, which is the lowest vertebrate, there is nothing that can really be called a brain. We have here the first example of an axial tube, the most fundamental part of the nervous system of vertebrates. The amphioxus possesses no eyes, no ears, no nose, and consequently no optic, auditory, or olfactory lobes. There is simply a fringe of filaments about the mouth, which may serve as rudimentary senses. The spinal cord gives off no branches. In fact, in the amphioxus and the lamprey, the lowest of fishes, the spinal cord is practically the entire nervous structure. From this fundamental simple structure let us note the gradual evolution of the highly complex nervous structure of the animals which perform the highest and most complex actions.

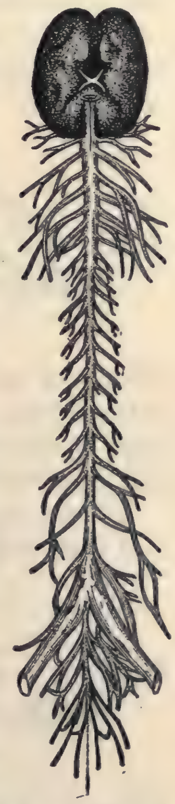

FIG. 10. — Human brain, spinal cord, and parts of radiating nerves. (From Orton.)

The nervous system of vertebrates comprises the brain, spinal cord, and the nerves. The brain and the spinal cord make up what is usually termed the central nervous system, and all the rest, excepting the sympathetic system, is called the peripheral system. The nervous system is the most complex and highly specialized system of the entire anatomy. It is composed of two kinds of neural substances, known from their color as the white and the gray matter. In the brain the gray matter is situated chiefly on the outside of the brain structure, forming the cortex; while in the spinal cord the white substance is on the outside, and the gray matter forms the central core.

[1] In all species except the very lowest.

With the development of the organs of special sense we find a corresponding increase in the size of the cephalic lobes, and the nervous system becomes correspondingly complex and differentiated. In fact, in the lower vertebrates the brain is largely an aggregation of centres or lobes controlling special sense organs. These centres are differentiations of the original

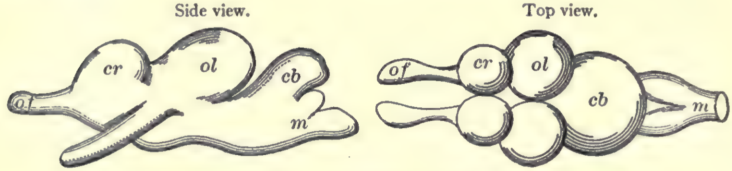

FIG. 11.—Brain of fish.[1]

spinal axis and not specializations of an originally undifferentiated brain. The cerebral portions of the brains of man and other higher adult mammals so overgrow and obscure the original lobes that the order of evolution is not always appreciated.

All fishes except the very lowest possess a quite highly specialized brain (Fig. 11). The cerebellum and the cerebrum are in

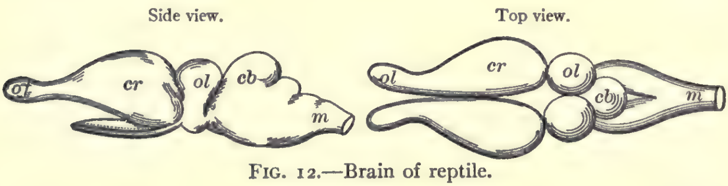

FIG. 12.—Brain of reptile.

evidence. Still, in fishes, the brain averages only about one-twentieth as large as it does in man. Olfactory lobes are definite, but the dominant features are the optic lobes. Sight seems to be the most important factor in the search for food and eluding pursuit of enemies. The sense of smell does not seem to be very prominent and there is little evidence of hearing in the true sense.

The cerebrum first makes its appearance as the largest lobe in the brains of reptiles (Fig. 12). Still, all the lobes of the brain

[1] In figures 11–16 observe the following: *of*, olfactory lobe; *ol*, optic lobe; *cr*, cerebrum; *cb*, cerebellum; *m*, medulla. (From Le Conte—except Fig. 15.)

are distinct and visible and the brain is not a homogeneous mass, but rather a succession of distinct lobes. The optic lobe is rather smaller than in fishes. The cerebellum is small and comports well with the general sluggishness of the animals. The medulla, the cerebral and cerebellar lobes, are exceedingly important additions, inasmuch as they seem to be the chief

FIG. 13.—Brain of bird.

organs for the co-ordination of movements which make complex associations possible. Even the most awkward and most loathsome reptiles probably display more intelligence than fishes.

The nervous systems of birds present a considerable advance over those of the reptiles (see Fig. 13). The brain as a whole is considerably greater in proportion to the weight of the body, and

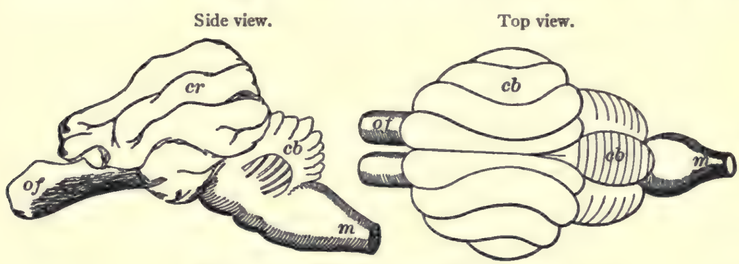

FIG. 14.—Brain of mammal. (Cat.)

also in proportion to the weight of the spinal cord. The cerebral hemispheres are greatly increased in size and present some evidences of convolutions—the first to be met with in the animal series. In the main, however, they are still smooth, as in fishes and amphibians. The olfactory lobes are not highly developed and, like the optic lobes, are largely covered by the cerebrum.

"The cerebellum," says Carpenter, "is of large size in conformity with the active and varied muscular movements performed by animals of this class; but it consists chiefly of the central lobe, with little appearance of lateral hemispheres." [1]

The various parts of the brain are no longer in serial order and a continuation of the spinal cord, but the brain is more of a homogeneous aggregation and the lobes seem more important than the stem.

When we come to mammals, we find many distinct advances in organization over any previously met. Not only do mammals

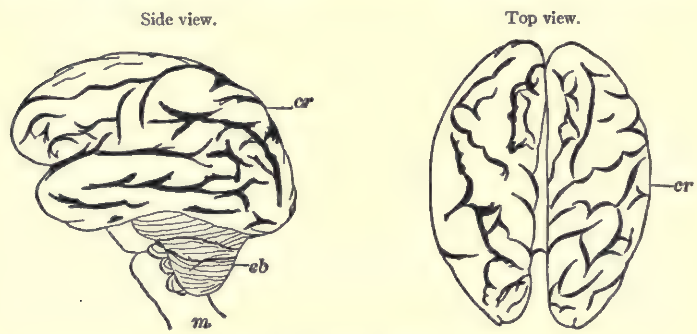

FIG. 15.—Brain of man.

as a class show higher development, but from the lowest to the highest mammalia there are also great strides. The differences are not only external but dissection reveals many advances in inner organization. The most obvious variation is in the extraordinary development of the cerebral lobes in proportion to the rest of the brain and the entire nervous system (see Figs. 14, 15, 16). In most of the mammalia these overgrow the brain-stem and the sensorial lobes so completely as to obscure them from view in the external examination, especially in lateral or a top view. In examining the brain of a higher mammal the novice would scarcely suspect that all the lobes were out-growths from the brain-stem. He would be apt to regard the brain as a unit and the spinal cord as an offshoot.

[1] *Mental Physiology*, p. 79.

The cerebellum in this series attains greater and greater importance. One other very important difference remains to be noted. All animals below mammals have practically smooth brains. The mammalia possess convoluted brains and the convolutions in general increase in number and complexity as we pass from the lower to the higher within this order. Man's brain possesses the most highly convoluted structure of all.

Le Conte's diagram (Fig. 16), showing the comparative development of the whole range of vertebrate brains, is very striking and extremely suggestive. The diagram not only shows the comparative sizes of the different brains as a whole, but also sets out in a very telling manner the relative proportions of the different lobes. It also illustrates the relation of the lobes to the original brain-stem. Have we not in this diagram a very forceful suggestion of the entire history of adaptation and education?

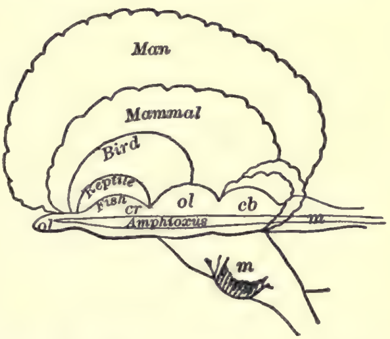

FIG. 16.—Diagram showing comparison of the different lobes of the brain in the ascending series of vertebrates.

Note the variation in the cerebral lobes. (After Le Conte.)

Comparisons Summarized.—In this very brief sketch of the comparative structure of the nervous system we have found several important differences in the various orders of life. The same kinds of differences are also distinguishable between the lower and the upper species of the same order. (1) There are differences in the amount of nervous matter possessed. There are all gradations from the amœba, practically nerveless, to man with a brain weighing approximately four pounds, besides an intricate system of nerves, fibres, and ganglia. (2) There are variations in the proportionate weights of brain and the entire nervous system. (3) There are differences in the amount of specialization. (4) In the ascending scale of life the cerebral lobes come

to be more and more prominent (see Fig. 16). (5) The convolutions, in general, are more numerous and deeper in the higher forms of life. (6) The degrees of specialization of the brain and nervous system correspond very closely with the different degrees of mental life. (7) There is a close parallelism between the zoological scale and the psychological scale.

Localization of Functions.—Not only is the vertebrate nervous system divided into specialized portions, as the brain, the spinal

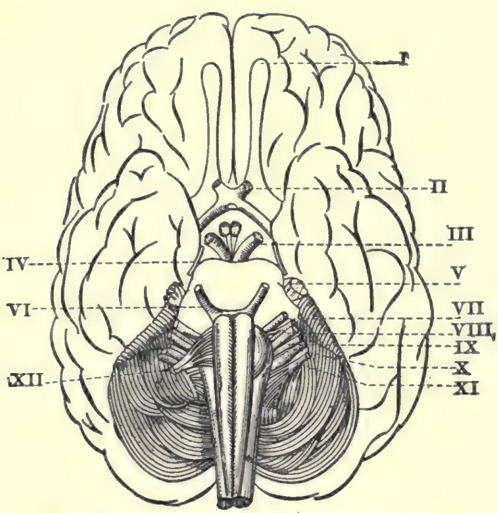

FIG. 17.—Human brain from under side.
I, olfactory bulbs; *II*, optic commissure; *III* to *XII*, cranial nerves.
(Drawn by Call.)

cord, and the nerves, but each of these parts is composed of still further differentiated tissues possessing particular functions. There are sensory and motor nerves, various tracts in the spinal cord; and the brain, which is a marvel of specialization, is itself composed of many lobes and areas each presiding over a specific function. Even the large divisions of the brain, the medulla, the cerebellum, and the cerebrum, are highly specialized. The control of special functions by certain specialized areas of the brain is termed localization of function. Many of the more obvious functions have been very definitely localized, others are

indefinite and under controversy, while in still other cases it is impossible to determine the specific functions of a given area, or conversely, to locate the area controlling a given function. It is quite probable that all parts of the nervous system may perform a variety of general functions in addition to the specific ones.

Localized Functions in Human Brain.—Man's central nervous system is estimated to have at least three billion nerve cells. Each one of these bodies is an entity, in a sense as separate and distinct and as simple, as a single amœba, yet all are united by living relations into a wonderful *system.* Although the organs work together as a unity, yet each has a special function to perform for the benefit of the whole. Thus each works with and for all, and all work with and for each. The nervous system is divided into the brain, the spinal cord, and the nerve fibres, and the brain in turn is subdivided into parts having special functions to perform. Briefly stated, the main functions of the several parts are as follows: [1]

I. The medulla oblongata controls (1) the centres fundamental to life processes, such as (*a*) respiratory, (*b*) cardio-motor, (*c*) cardio-inhibitory, (*d*) vaso-motor; (2) the centres concerned with alimentation, including (*a*) mastication, (*b*) deglutition, (*c*) vomiting, (*d*) sucking; (3) the centres controlling the eye, including (*a*) winking, (*b*) dilatation of the pupil; (4) the centres controlling secretions, including (*a*) salivary, (*b*) lachrymal, (*c*) perspiration.

II. The cerebellum contains centres especially connected with (*a*) emotional life, and (*b*) centres for co-ordination of movements.

III. The cerebrum contains (1) the hemispheres, which are primarily centres controlling psychical processes, (2) the basal ganglia, chief of which is the optic thalamus connected with the sense of sight, (3) the corpora quadrigemina connected with sight, and (4) the internal and external capsules, the former of which is associated with both sensory and motor processes. The functions of the latter are not well known. The hemi-

[1] Whitaker, *Anatomy of the Brain and Spinal Cord*, p. 156.

spheres contain several well-marked areas, (*a*) the centre for or connected with sight occupying the occipital lobes and the angular gyrus; (*b*) the centre associated with hearing situated in the temporal-sphenoidal lobe; (*c*) the centres controlling taste and smell situated in the temporal lobe but within the brain and seen only in a median section; (*d*) the speech centre in the left inferior frontal convolution (in left-handed persons this centre is on the right side); (*e*) the motor centres located in the region

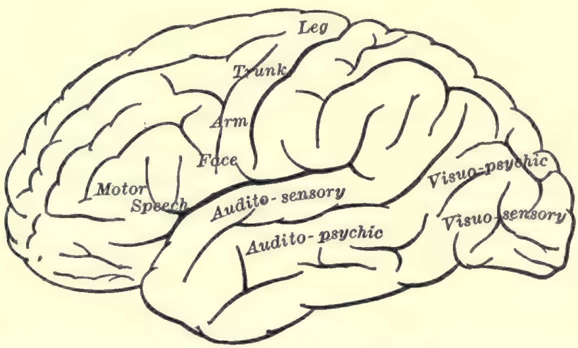

FIG. 18.—Lateral surface of the human brain, showing certain localized areas. (Drawn by Call.)

of the ascending frontal and parietal convolutions, adjacent to the fissures of Rolando and Sylvius.

Means of Determining Localization.—The functions of the specialized areas of the brain have been determined in two ways. Disturbances of function have been observed during the life of the individual and post-mortem examinations have revealed injuries or disease in certain portions of the brain. When a sufficient number of cases have been observed showing the same facts of functional derangement and anatomical disease or lesion, reasonable certainty of the relation may be assumed. But there is another method of discovering and testing these facts and relations. By stimulating a given portion of the brain when exposed by accident or vivisection, muscular reactions are occasioned and the direct relation may be easily discovered. Many purposive experiments have been performed and much valuable evidence acquired.

If the brains of dogs or monkeys, or other animals, are stimulated electrically, well-defined movements are produced in some part of the body; for example, in the face, tail, fore-leg, hind-leg, according to the portion of the brain stimulated. Moreover, the movements produced are on the opposite side of the body. All experiments confirm the belief that each hemisphere of the brain controls functions on the opposite side of the body. The crossing of nerves in the medulla indicates the same fact.

If a portion of the brain is excised or destroyed, the corresponding functions will be inhibited or destroyed. Paralysis of various

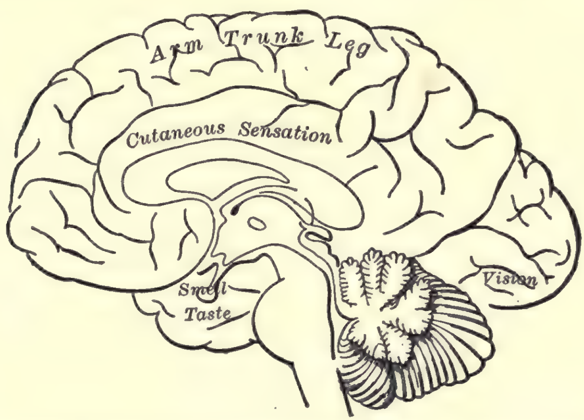

FIG. 19.—Mesial surface of the human brain, showing several localized areas. (Drawn by Call.)

organs results from disturbance of certain portions of the nervous system. The disturbance may be caused by pressure or degeneration. In many cases caused by pressure, physicians are able to diagnose accurately and afford relief by cutting into the skull and relieving the pressure. Trephining to relieve paralysis is now very common. Halleck cites two cases. The first was that of an epileptic patient in whom all the preliminary twitchings began in the left shoulder. "The surgeons cut a circular hole immediately over the shoulder centre. Beneath the incision they found a small tumor, which they removed." The second case was that of a sewing-girl in whom all the pre-

liminary convulsions began in the right thumb. "The surgeons cut through the skull directly over the motor centre for the hand. Then they stimulated the brain cortex until they found a surface where the thumb alone was flexed. It was necessary to determine this point accurately, for if the brain beyond this was injured, the hand and entire arm would be paralyzed. . . . The surgeons succeeded in removing the thumb centre alone, and, as a result of the operation, her epileptic attacks were fewer and milder in number. She also had the use of her hand." [1]

Of the wonderful accuracy and progress in localizing brain areas, Dr. Keen wrote: [2] "When I say that the existence of a tumor about the size of the end of the forefinger can be diagnosticated, and that before touching the head it should be said that it was a small tumor, that it did not lie on the surface of the brain, but a little underneath it, that it lay partly under the centre for the face and partly under that for the arm in the left side of the brain, and that the man was operated on, and the tumor found exactly where it was believed to be, with perfect recovery of the patient, it is something which ten years ago would have been deemed the art of a magician rather than the cold precision of science."

Localization of Brain Not Exceptional.—There is nothing strange in the fact of localization of function in the brain, although some people are incredulous concerning it. No one regards it as strange that the body is divided into head, trunk, arms, legs, hands, heart, liver, and spleen, each subserving a specific function which no other organ can perform. It is accepted as a matter of course that the eye cannot hear, the ear see, or the hand taste. Even the division of the nervous system into brain and nerves excites no comment. But as soon as specialization of function in the various portions of the brain is mentioned, doubts begin to arise. Of course, the different parts are related—sometimes very closely indeed. So also are the ear and the œsophagus, both having arisen from the same

[1] *Education of the Central Nervous System*, p. 15.
[2] *Vivisection and Brain Surgery.*

original tissue. The linings of the stomach and the outer skin of the body are the same in origin. Traced to their origins we find that the brain, muscles, bones, skin, hair, and in fact all the varied tissues of the body were derived from common ancestral cells. A given kind of food may be taken by one individual and simply build up bone and muscle, while taken by another it may serve to develop brain and furnish the physiological basis for evolving idealistic philosophy or writing poetry. A dog and a man may subsist on an identical quality and quantity of food, but how different the resultants!

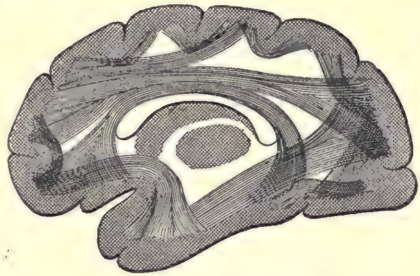

FIG. 20.—Localized areas of the brain, showing association fibres.
(After Starr, from Donaldson's *Growth of the Brain*, p. 267.)

The facts revealed by an examination of the brain of Laura Bridgman were very significant. She was in possession of all her senses until three years old, when scarlet fever deprived her of the sight of the left eye. She could see a little with her right eye until eight, when she became entirely blind. From three years of age she was stone-deaf. Consequently she was devoid of experiences to awaken the areas of sight and hearing. It was found that those areas of the brain were much less well developed than the corresponding areas of normal brains or the other areas of her own brain. Dr. Donaldson, who made the examination of the brain with such minute care, said: "In this connection it is interesting to notice that those parts of the cortex which, according to the current view, were to be associated with the defective organs, were also particularly thin. The cause of this thinness was found to be due, at least in part, to the small size of the nerve cells there present. Not only were the large and medium-sized nerve cells smaller, but the impression made on the observer was that they were less numerous than in the normal cortex." As we now might expect,

he found the right side of the cortex in the occipital region much thinner than the left side. Undoubtedly the earlier blindness of the left eye caused the earlier arrest or atrophy of the left side of the visual centre, and the experiences in seeing with the right eye, even though poorly, for a few years, caused the superior development of the centre controlling that eye.[1]

Association Tracts a Form of Localization.—Another type of brain specialization and localization of much interest and importance educationally is found in the special mechanisms for association. These are the association fibres (*a*) connecting the adjacent convolutions; (*b*) those connecting different tracts, especially those connecting the frontal and occipital, and the frontal and temporal areas; and (*c*) those connecting sensory and motor areas (see Fig. 20). The commissural fibres connecting the two hemispheres are in reality association fibres securing harmony between the actions of the two halves of the brain.

The groups of association fibres connecting the various convolutions are so definite as to be readily seen with the naked eye, as are those between the larger lobes. These are all well established by heredity and only await proper stimulation to develop fully. That they need proper exercise is shown by the facts that at birth they are undeveloped and they develop best in those with normal experiences. In the feeble-minded they are poorly developed.

Obscure Association Tracts.—But there are other association paths not so easy of observation; in fact, most of what we know of them is through the observed data of nervous anatomy and the well-tested data on the transmission of nervous energy, and through our knowledge of functional relations established. While we cannot always see the relations by a study of anatomical structure, we can observe the behavior through expression. Just as we know that every impression must result in some motor expression, we are also sure that every series of muscular and psychic connections is the consequent of nervous connections

[1] Donaldson, *On the Brain of Laura Bridgman, Am. Jour. of Psych.*, Sept., 1890, Dec., 1891.

established. Any set of sensory cells may become connected with any other sensory cells or any other motor cells. We know that we connect visual impressions with other visual impressions, and also with sounds, tastes, and smells, and with a variety of motor activities. Because of these psychic relations and because of the knowledge of psycho-physical parallelism we know that neural connections are established, though not possible to be seen. In fact, the brain, as suggested before, is a wonderful co-ordinating machine. The greater the complexity of co-ordinations and the finer their adjustments, the higher the type of brain and the higher the type of intelligence of its possessor. Contrast the brains and activities of a reptile with those of man, who can play a piano, make a watch, construct an engine, or paint a picture.

FIG. 21.—Projection fibres of the human brain. (After Starr, from Donaldson's *Growth of the Brain*, p. 256.) Note how all the tracts of projecting fibres have their origin in the original stem of the nervous system. They represent specialized portions and go to still other specialized portions.

Undoubtedly a caution should be given against thinking that all functions can be localized or that each portion of the brain can be demonstrated to control a particular function. Specialists in anatomy and physiology are particularly cautious in their statements on this matter. A good many facts have been definitely established and much progress is being made.[1] Undoubtedly each complex action functions in many centres, and also without doubt each centre functions in many kinds of actions. The association tracts connecting the various centres are probably much more specialized and limited in their functions than are the centres. May we not compare the centres to

[1] See Howell, *Text-Book of Physiology*, chap. IX; Church and Peterson, *Nervous and Mental Diseases*, pp. 161–180; and other medical works.

offices carrying on a multiplicity of functions, receiving, interpreting, and sending, while the pathways, ingoing and outgoing, are limited in function? Furthermore, should not the whole circuit—ingoing impulse, transforming centre, associating connectives, and outgoing impulse—be regarded as a localized centre? Thus the topography becomes very complex and difficult to localize. Certain great centres, like vision, hearing, taste, and smell, are tolerably definite, but all complex activities must become lost in the maze of centres and connectives. This does not minimize the reality of localization—in fact, emphasizes it—but gives us the concept of dynamic relations rather than topographical definiteness alone.

Donaldson says:[1] "The sensory impulse reaching the cortical cells may thus be compared to a complex sound wave striking upon resonators, each one of which picks out that vibration to which it has been attuned and responds to it. Moreover, to push the simile further, the pitch of responsive cells may be altered by the play of other impulses upon them, and thus the analysis at different times is not the same. Refinement in the structure of the cerebral cortex may, therefore, be developed in three ways: first, by the multiplication of the pathways bearing the incoming impulses; second, by rendering more sensitive to slight differences in the stimulation those cells whose function it is to receive these impulses; and third, by increasing the number of the central cells. So far as can be seen at present, the brains of the lower and less intelligent mammals are inferior in all these respects, but are most deficient on the side of the afferent and central elements."

Importance of Cerebral Specialization.—Professor Ewald Hering wrote of the specializations of the cerebrum: "The different parts of the hemispheres are like a great tool box with a countless variety of tools. Each single element of the cerebrum is a particular tool. Consciousness may be likened to an artisan whose tools gradually become so numerous, so varied and so specialized that he has for every minutest detail of his

[1] *Growth of the Brain*, p. 268.

work a tool which is specially adapted to perform just this precise kind of work very easily and accurately. If he loses one of his tools he still possesses a thousand other tools to do the same work, though under disadvantages both with reference to adaptability and the time involved. Should he happen to lose one of these thousand also, he might retain hundreds with which to do the work still, but under greatly increased difficulty. He must needs have lost a very large number of his tools if certain actions become impossible."

Diffusion of Energy Before Specialization of Function.—In the human infant do we not find rather amœboid diffusion of nervous energy? For a long time, although sensitive to a great variety of stimuli, its muscular co-ordinations are very crude and uncertain. At first the hand clutches objects convulsively, and is very liable to drop them, because the constant dispersion of nervous energy causes new contractions and expansions. To learn to creep, sit, stand, and talk requires months, even years, and ceaseless trial and error. To be able to pick up a pin, hold the knife and fork properly, or to button clothing, means long strides in the educative process.

Even in processes of formal instruction we find analogous conditions. When the child begins to write, instead of holding the pencil lightly and executing with ease and facility by means of fore-arm or finger movements, he grasps the pencil with all his might, his body writhes and his face is in contortions. Why this exhibition? Simply because a superfluous amount of nervous energy is being liberated, useless movements are set up, and the energy instead of being confined in particular channels is diffused. It is interesting to watch some adults try to cut with scissors. The nervous energy is so diffused that part of it goes to the jaws. In learning to tie a knot, in learning to skate, etc., much energy is diffused and useless movements occur.

Education a Process of Forming Organized Pathways.—Education is thus seen to be in part a matter of forming organized pathways of discharge in the nervous system. This is true whether of simple activities or those more complex ones con-

nected with formal educative processes. For example, in learning to talk the child must spend many months of laborious effort in accustoming the vocal organs to respond to the mandates of the mind. Some have maintained that the reason the child does not pronounce his words accurately is because he does not hear accurately. It is true that the acquisition of fine discrimination among sounds is of slow growth, yet careful experiments reveal that children hear accurately considerably before they are able to control accurate vocalization. Learning to sing necessitates fine adjustments and co-ordinations and often requires much time. In learning to speak a foreign language the difficulty experienced in pronunciation, stated physiologically, arises because nervous energy is diffused instead of being confined to definite pathways of discharge.

Since much of every-day education is concerned with muscular reactions, the problem is to establish definite co-ordinations insuring prompt and easy responses. This implies the formation of definite nervous mechanisms which shall serve as pathways of discharge of nervous energy. Halleck says that these habit-worn channels are as necessary as good roadways in the settlement of a new country. It is just as necessary to develop pathways of nervous discharge, so that nervous energy may take paths of least resistance, as it is to have insulated wires to transmit electricity. Uninsulated wires diffuse the currents while insulated wires limit them to definite channels.

The largest and most important business of education is to establish myriads of appropriate and efficient associations between stimuli and responses. The man is to be taught so that when stimulated to write, draw, pull a throttle, or manipulate a surgical instrument, he can do so with precision and dexterity. Such results are consequent only upon long practice, that is, through the establishment of habits of well-worn pathways of nervous discharge.

Formation of Association Paths.—Some simple cases will be taken to illustrate the process of establishing association paths through educative processes. Suppose one is to learn to recog-

nize another and to call him by name when they meet. An association must be established between the sight of the person (element *a*) and the sound of the name (element *b*). The first time the name is heard an attempt is made to fix the name in connection with the visual appearance, *i. e.*, a connection is set up between *a* and *b*. Neurologically a transfer of energy has taken place from the centre of sight to the centre of hearing, which we may designate diagrammatically as *a*———> *b*. The next time the stimulus comes the action is a little easier and at succeeding times still easier. Nutrition is supplied, the neurons grow to that mode, and soon the track becomes thoroughly established physically and mentally, the action becomes reflex, and a habitual response is the result. Since little attempt is made to recall the image through the sound of the name, the path *a*———> *b* is much better established than the path *b*———> *a*. In fact it is possible for the association from *a*———> *b* to become practically automatic with little or no power of recall in the other direction. Witness this in learning the alphabet in one direction, in translating from German to English, etc. Selecting a case from the school arts—learning to read and write a word—we find a much complicated set of processes. It would be essentially as follows: The child knowing the visual appearance of the cat would learn the word cat as it sounds, thus establishing dynamic connections between *a*———> *b*. As he associates reciprocally the word and the object, he establishes a dynamic relation in the opposite direction or from *b*———> *a*. His new work in learning to read is to establish relations between sound and sight. It is doubtless some time before the sound of the letter calls up its sight. Speaking children must learn to pronounce the word when seen or heard or when the object is beheld.

Gradually reciprocal associative relations must be established between seeing the object or the word, hearing the word, and writing. Ultimately the paths between each centre and every other centre controlling a particular element must become so established that any one may act as a stimulus to call up

every other. The various processes are schematically represented in Fig. 22.

In most of our knowledge some one element in a group usually serves better than any others as a stimulus. In becoming acquainted with persons, for example, the visual percept is much more liable to awaken recognition than is the name. The relations are probably largely dynamic, but not less real than if large bundles of fibres had actually been developed. This is no more improbable than the fact that electricity passes through some substances in one direction better than in another, or that one end of a magnet will attract and another repel. Outwardly we can observe no reasons for the behavior, but the behavior is our witness. The microscope reveals no difference between the magnetized and the unmagnetized iron, but we all know that they are different dynamically. That nerve currents travel in one direction better than in another we also know through the behavior, even though outward appearances of structure may not reveal it.

Conservation and Cumulation of Effects.—It may be well again to assert here that whenever a stimulus produces a change in the nervous system the resultant effect is conserved. The law of the conservation of energy in nature is as operative here as in the case of iron affected by torsion, one solid struck by another, heat converting water into steam, etc. The same law holds true in the psychic realm. Nothing is lost, and nothing comes by chance. Whenever the nervous system has been modified, on the recurrence of the same stimulus it is able to react more successfully and the path is in the process of becoming the path of least resistance. Inhibitions are built up in a similar manner. That is, whenever discomfort arises from a given action the connection tends to be weakened and opposing paths established.

We have a right to believe that the effects of every experience, no matter how insignificant, are registered. The effects are cumulative and by this means development proceeds. Although we are unable to determine by any known means just how much

a brain is modified by a lesson in arithmetic, Latin, or psychology, yet we are absolutely confident that some modification has taken place and that it will be conserved. If we had microscopes powerful enough and means of applying them to the brain, we could doubtless note the close relation between exercise of function and the development of structure. We should find that those centres of the brain which are opportunely exercised upon the right material develop better than other centres deprived of appropriate stimuli. We should note a difference between the growth of some children mentally starving for want of appropriate stimuli and others forging ahead because abundantly supplied, just as we see the differences between the pale faces and emaciated bodies of some and the ruddy complexions and robust forms of others.

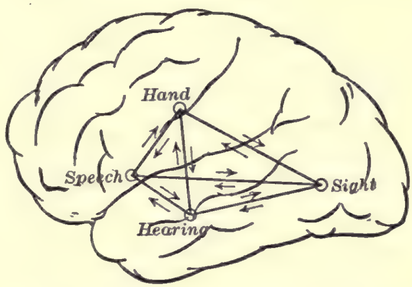

FIG. 22.—Schematic representation of the paths of association formed in reading and writing.
(Drawn by Call.)

The facts of aphasia have contributed much to our knowledge of the intimate relation between the development of nerve elements and mental growth. They also show how experience—education—has to build neural connections between different centres. Most of our percepts and memories are exceedingly complex and may be aroused through numerous channels. In aphasia, which is merely loss of memory of a special type, it frequently happens that elements which have once served as stimuli to awaken the entire chain of relations fail to serve in this capacity. For example, it may occur that a man is unable to write his name when he sees it written while he may still be able to write it if it is pronounced. He may be unable to pronounce his name if he hears it, but may be perfectly able to do so if it is written. He may be unable to speak or write the word bell if

the bell is seen, though he can do so if the bell is rung. The explanation is that the association tracts between some of the different elements have become functionally deranged through disease or pressure and the transmission of impulses is inhibited. Sometimes it is very temporary, caused by fatigue, and sometimes much more serious, when lesions have been produced.

Effects of Use and Disuse.—Just as the efficiency of physical and mental action is destroyed by injuries to the central nervous system and the various interconnecting pathways, so the brain may fail to become an efficient instrument by lack of development of the cell elements and the various connecting fibres. Neurologists inform us that the number of cells is probably as great at birth as at maturity. But all except the lowest levels controlling the vital functions are "unripe." Experience—education—must determine the number that come to functional maturity. Through experience medullation begins to take place and connections to be established. Stimulations from the outside world begin to pour in through the senses and development proceeds. At first very simple sensory experiences and motor reactions are established. Later the association fibres become so well established and so complex in character that real thinking and deliberation may take place. These are not possible in a simple system where energy is diffused as is the case in lower animals and immature children. The association fibres in the human brain make their best development during adolescence, though growth does not cease until maturity—probably later. Coincident with this neurological development the power of thought proceeds. It is futile for teachers to expect thought power to manifest itself until the anatomical substructure is established. Since the anatomical development is contingent upon nutrition, sleep, rest, and various hygienic factors, it is preposterous to expect good mental development regardless of them (see the chapter on "Fatigue").

Importance of the Plastic Period.—If nerve cells are ever developed to functional maturity and efficiency, it must be accomplished during the plastic period of childhood and youth.

During these periods the nervous system is responsive to education. It is a notable fact that restitution of function may occur when brain injuries occur in childhood and youth, but seldom later. In man the paralysis of a limb caused by brain injury is usually permanent, but in a child not frequently so. Injury to one hemisphere occurring in youth may be compensated by special development and transference of function to the other, but in adults this is no longer possible.

"The intensity with which any form of exercise is carried on during the growing period leaves its trace, and the absence of it at the proper time is for the most part irremediable. We should hardly expect much appreciation of color in a person brought up in the dark, however good his natural endowments in this direction. Thus any lack of early experience may leave a spot permanently undeveloped in the central system—a condition of much significance, for each locality in the cerebrum is not only a place at which reactions, using the word in a narrow sense, may occur, but by way of it pass fibres having more distant connections, and its lack of development probably reduces the associative value of these also." [1]

Donaldson further says: [2] "It has been made probable that by the cultivating processes of school training the formed structures tend to be strengthened, dormant elements roused to better growth and organization, and made more perfect in this or that direction according to the nature of the exercise. By strengthening the formed cells their powers of differential reaction, of organic memory, and resistance to fatigue are increased. By associating given sets of muscular reactions with given sense impressions habits are formed. in consequence of further organizations among the nerve elements, and finally nutritive rhythms associated with the periods of activity and rest are established, with the result of economizing the bodily energy, and rendering its expenditure more effective."

Correlation of Nervous, Muscular, and Mental Actions.—The only means we have of knowing mind is through muscular

[1] Donaldson, *Growth of the Brain*, p. 348. [2] *Op. cit.*, p. 344.

responses. If we are to interpret psychic processes correctly, then there must be accurately co-ordinated sensations and muscular reactions. What one says orally or writes, what one paints, models, moulds, or makes, how one uses his various muscles, indicate what his mind is doing. Even in examining students to determine their grades we are obliged to rely upon some of these manifestations. If they speak or write incorrectly we judge that their thoughts have been inaccurate. From impression to expression is a law of psycho-physics. It is exceedingly important in education. It will be shown later that impressions and expressions react reciprocally upon each other. Just as we may know of the healthful activity of mind and brain through muscular actions, we may also discern signs of mental disease. Warner says:[1] "The general condition of the nerve-system is expressed by motor signs—freshness, fatigue, irritability, all may be indicated to us by movements of the child, the absence of movements, or by the attitude or posture of the body, which depend upon motor action."

It thus becomes perfectly apparent that the problem of education is as much concerned with the education of the nervous system as of the mind. Later discussions will also go to show how much it is concerned with muscular adjustments and the co-ordination of mental and muscular activities. The brain is the great co-ordinating organ, making possible higher forms of choice, inhibition, and volition. To succeed in improving or systematizing the child's expressions means that corresponding improvement has taken place in his brain and nervous system. Every controlled and co-ordinated movement means the correlation of well-defined brain tracts and association areas. Conversely improvement of the brain and the establishment of organized pathways of nervous discharge are necessary for improved mental action.

Evolution of Nervous System Means Education.—It is readily noted that the nervous system becomes more and more complex with the ascending scale of life. In the lowest forms of life,

[1] *The Study of Children*, p. 40.

with simple needs and activities, no nervous structure is ever visible. Their organic structures are as undifferentiated as their functions and activities. With the appearance of differentiated functions arise specialized structures to fulfil the varied functions. We may go even further and assert simply a biological law, viz., that the specialized structures arise through the exercise of special forms of activities. That is, the experiences functioning in a particular way accentuate organs and cause their development in harmony with the actions. The individuals and even nervous organs of the individuals become accustomed to acting in specialized ways because these modes are found advantageous. Each activity tends to develop the function and structure still further. Habits are engendered which tend to be conserved, and in this way the future conduct is determined. As before stated, whatever biases the individual, or an organ, toward a particular mode of conduct is educative.

Thus the whole development and specialization of the nervous system in the ascending orders of life represent a process of education. The type of growth and the manner of functioning at any given stage represent the resultant of all previous experiences—education. As fast as activities have been experienced nature has recorded the effects indelibly in the nervous system. Thus, while the nervous system of any organism represents the kind and degree of possibilities of further experiences, it reciprocally indicates the kind and degree of experiences which have been received. While it is true, for example, that the brain of the bird is not fitted for a very high order of thinking, it is equally true that the birds and their ancestors have never indulged in very complex mental gymnastics. The most fundamental life processes, physical co-ordinations, relatively simple perceptions of sight, sound, and smell, have sufficed for their preservation. In the more sagacious animals like the dog, ape, and elephant, we find much more complicated brain structures both as a cause and as an effect of their increased intelligence. The cerebellum, the lobes of sight, smell, and hearing, are no smaller, and there is a noticeable increase of cerebrum.

Experience (Education) Has Produced Development.—In man we find that the cerebrum is vastly larger proportionally than in any other animal, and also that the frontal areas are for the first time prominent. Even in human beings we find that there is a great difference between the development of the frontal lobes of the lower and the higher races, and between children and adults. This is very significant educationally. It represents again, both cause and effect; possibilities and resultants of education. There is absolutely no question that the adult with the well-developed frontal brain areas is capable of thinking, reasoning, and willing in a way impossible to a child in which this development has not yet taken place. Similar differences between civilized and primitive man are equally apparent. It is also thoroughly demonstrable that education will tend to produce this development, or lack of it cause degeneration and atrophy. Venn studied the growth of the heads of Cambridge students and found that the heads of the best students grew longest and largest. Measurements secured before and after their university course showed that their cranial growth was greater than in non-students at corresponding periods. Investigations show that loss of brain weight, common to middle life and old age, does not take place so early nor so rapidly in the case of eminent men as in others. Although their brains have an inherited initial superiority, yet neurologists believe that there is no doubt that judicious mental exercise postpones decline.

Donaldson, on the authority of Bischoff, says that the final decrease in the weight of the encephalon usually begins in men at about fifty-five years, and in women some years earlier. His curves indicate that the decline in the weight of the brains of *eminent men is deferred till after sixty-five years.*[1] This, however, should not seem strange. Persons who maintain a vigorous muscular tone through rational physical exercise preserve their muscular vigor until a later age than those who have never cultivated their muscles.

[1] *Growth of the Brain*, p. 325.

Galton regards proper exercise of the brain as a prerequisite of growth and a lack of it as a cause of degeneration. He wrote:[1] "Although it is pretty well ascertained that in the masses of the population the brain ceases to grow after the age of nineteen, or even earlier, it is by no means so with university students." Venn wrote:[2] "Comparing the 'head volumes' of the students, two facts claim notice, viz., first, that the heads of the high honor men are distinctly larger than those of the pass men; and second, that the heads of all alike continue to grow for some years after the age of nineteen." Consequently the measurements so carefully made by Venn are exceedingly significant.

Has Evolution Ceased?—It is very interesting to consider whether specialization has reached the limit in the case of man's brain and psychic life. John Fiske wrote,[3] as a chapter heading, these striking words: "On the earth there will never be a higher creature than man." Drummond in his chapter on the arrest of the body,[4] commenting upon the statement, says: "It is a daring prophecy, but every probability of science attests the likelihood of its fulfilment. The goal looked forward to from the beginning of time has been attained. Nature has succeeded in making a man; she can go no further; organic evolution has done its work."

While acknowledging that psychical evolution is the type of all further human progress, yet we should not regard present physical development as by any means complete, nor the present type of man as perfect. "Man is the tadpole of what he is to be," the favorite phrase of Dr. G. Stanley Hall, is much nearer the truth. Struggle for still higher ideals than have ever been held will tend to develop a higher type of psychic life than any yet realized; and as mental life in all its phases of development has been paralleled by nervous and muscular development and has rendered the psychical evolution possible, may we not expect still higher development of both physical and mental life? Because of psycho-physical parallelism it must follow that if further

[1] *Nature*, 41: 454.
[2] *Nature*, 41: 452.
[3] *Destiny of Man*, p. 26.
[4] *Ascent of Man*, p. 99.

progress in mental life is to be attained in any direction, there must be corresponding structural adaptation of the physical organism.

For example, in order to attain a higher appreciation of music, it is undoubtedly true that a more delicate auditory organism must be evolved. And with a constantly heightening ideal of music and a struggle to cultivate better understanding and appreciation this conscious selection must have as one effect—that of a more highly developed organism. Similarly more sensitive visual organs may be developed which would be sensitive to tints and colors and fine shades of difference not now possible to the imperfect eye. The sense organs of touch may become so delicate that grades of workmanship and professional skill in the artist, the physician, etc., hitherto undreamed of, may be made possible. Of course, some organs and powers may degenerate, but indefinite variation and change are not only possible but extremely probable. Within historic times, even in a few generations, I am pleased to believe, permanent modifications have taken place in man's brain and sense organs through cultivation of powers present and in response to the struggle for the attainment of higher ideals. We do not marvel when the breeder produces complete transformation through selection and the emphasis of desirable qualities. New breeds of horses and dogs, unrecognizable as related to the old through outward appearance, and vastly superior in mental qualities, are secured in a few generations.

"Shall it stop here? Shall it not be carried forward on a higher plane by the conscious effort of man? Is not all civilization, all culture, all *education* a *voluntary* process of cephalization? Here, also, there must prevail the same law of progressive domination of the higher over the lower, of the distinctively *human* over the animal, of mind over body; and in the mind, of the higher faculties over the lower, the reflective over the perceptive, and of the moral character over all. In all your culture be sure that you strive to follow this law of evolution." [1]

[1] Le Conte, *Comparative Physiology and Morphology of Animals*, p. 83.

CHAPTER IV

THE THEORY OF RECAPITULATION

Progressive Development of the Individual.—All individuals begin life as a single cell and it is only after gradual differentiation and specialization that complex animal forms are evolved. Wallace remarks apropos of this: "The progressive development of any vertebrate from the ovum or minute embryonic egg affords one of the most marvellous chapters in natural history. We see the contents of the ovum undergoing numerous definite changes; its interior dividing and subdividing till it consists of a mass of cells; then a groove appears marking out the median line or vertebral column of the future animal, and thereafter are slowly developed the various essential organs of the body." [1] Huxley remarks in the same connection after describing the progressive changes in the canine embryo: "The history of the development of any other vertebrate animal, lizard, snake, frog, or fish, tells the same story. There is always to begin with an egg having the same essential structure as that of the dog:—the yolk of the egg undergoes division or segmentation, as it is called, the ultimate products of that segmentation constitute the building materials for the body of the young animal, and this is built up round a primitive groove, in the floor of which a notochord is developed. Furthermore, there is a period in which the young of all these animals resemble one another, not merely in outward form, but in all essentials of structure, so closely that the differences between them are inconsiderable, while in their subsequent course they diverge more and more widely from one another. And it is a general law that the more closely any animals resemble one another in adult

[1] *Darwinism*, p. 448.

structure, the longer and more intimately do their embryos resemble one another: so that, for example, the embryos of a snake and of a lizard remain like one another longer than do those of a snake and of a bird; and the embryos of a dog and of a cat remain like one another for a far longer period than do those of a dog and a bird; or of a dog and an opossum; or even those of a dog and a monkey." [1]

Resemblances of Embryos to Lower Adult Forms.—It has long been observed that the embryos of the higher animals at different stages resemble somewhat the adult forms of various lower species. The more immature the embryo the lower the species resembled, and the more mature the embryo the higher the species which it approximates. In the case of animals which undergo metamorphoses in attaining adult life the immature stages so completely resemble other adult forms that they are frequently regarded as another species. For example, moths and butterflies in the larval stage would naturally be classed with the worms by the unscientific. The young of frogs and toads, the tadpoles, are animals fitted to live in water only, and certainly would be classed with fishes if it were not known what subsequent metamorphoses would take place.

Marshall wrote: "Everyone knows that animals in the earlier stages of their existence differ greatly in form, in structure, and in habits from the adult condition. A lung-breathing frog, for example, commences its life as a gill-breathing tadpole; and a butterfly passes its infancy and youth as a caterpillar. It is clear that these developmental stages, and the order of their occurrence, can be no mere accidents; for all the individuals of any particular species of frog, or of butterfly, pass through the same series of changes. . . . Each animal is constrained to develop along definitely determined lines. . . . The successive stages in its life history are forced on an animal in accordance with a law, the determination of which ranks as one of the greatest achievements of biological science." [2]

[1] *Man's Place in Nature*, p. 88.
[2] *Biological Lectures and Addresses*, p. 201.

The Law of Recapitulation.—For a long period during the course of development the embryo of a given animal is so similar to the embryos of many other animals as to be difficult of distinction. It was Agassiz who first pointed out that there is a definite resemblance between certain stages in the growth of young fish and their fossil representatives. He drew the conclusion that, "it may therefore be considered as a general fact, very likely to be more fully illustrated as investigations cover a wider ground, that the phases of development of all living animals correspond to the order of succession of their extinct representatives." This resemblance of embryonic stages to the adult forms of lower species led to further investigations which resulted in the belief that these embryonic stages represented an ancestral type. The embryonic conditions at various stages not only resemble other species, but they actually represent a stage of progress at which some ancestors ceased in their development. Inasmuch as each complex animal represents a series of successive stages of animal life, it is said to recapitulate in its individual development the life history of the race.

The law of recapitulation first hinted at by Agassiz, later more directly by Von Baer, but which was first definitely formulated by Fritz Müller and frequently referred to as Von Baer's law, briefly stated is as follows: The individual in its development passes through or recapitulates the various stages which the race has passed through in reaching the stage represented by the individual. Most of the facts that support this theory have been derived from biology and embryology. Paleontologists have found extinct animal series representing many stages of the developing embryos of present-day animals. The fossil remains represent, of course, adult forms, and hence it is thought that these represent racial stages of the ancestors. Therefore it is said that ontogeny recapitulates phylogeny.

Marshall states that, "The doctrine of Descent, or of Evolution, teaches us that as individual animals arise, not spontaneously, but by direct descent from pre-existing animals, so also it is with species, and with larger groups of animals, and so also

has it been for all time; that as the animals of succeeding generations are related together, so also are those of successive geologic periods; that all animals living or that have lived are united together by blood relationship of varying nearness or remoteness; and that every animal now in existence has a pedigree stretching back, not merely for ten or a hundred generations, but through all geologic time, since the dawn of life on this globe.

"The study of Development, in its turn, has revealed to us that each animal bears the mark of its ancestry, and is compelled to discover its parentage in its own development; that the phases through which an animal passes in its progress from the egg to the adult are no accidental freaks, no mere matters of developmental convenience, but represent more or less closely, in more or less modified manner, the successive ancestral stages through which the present condition has been acquired. Evolution tells us that each animal has had a pedigree in the past. Embryology reveals to us this ancestry, because every animal in its own development repeats its history, climbs up its own genealogical tree." [1]

Rudimentary Organs.—In the animal body are found some organs which subserve no function, at least in the adult. Sometimes they fulfil some function in the embryonic development, and again they reach only a rudimentary stage. These vestigial organs are the rudiments of structures which once performed some useful service in the animal economy. But whenever the need ceases the organ tends to disappear, some say through disuse, others maintain through natural selection—undoubtedly both. At any rate their former need has ceased to exist, because of a change of habit or because of different conditions of living, and the organs are now dying out. LeConte says: "All through the animal kingdom, especially in the more specialized forms of mammals, we find rudimentary and often wholly useless organs. These are evidently remnants of once useful organs, which have dwindled by disuse, but have not entirely disappeared. Examples meet us on every side." [2]

[1] *Biological Lectures and Addresses*, p. 201.
[2] *Comparative Physiology and Morphology of Animals*, p. 258.

Darwin years ago pointed out that "organs or parts in this strange condition, bearing the plain stamp of inutility, are extremely common, or even general, throughout nature. It would be impossible to name one of the higher animals in which some part or other is not in a rudimentary condition."[1] Fœtal whales have teeth though when grown they have not a tooth in their heads; calves have rudimentary teeth which never cut through the gums. Some organs are rudimentary in the sense that they do not function, though perfect; that is, they are useless. There is a species of salamander (*Salamander Atra*) which lives high up in the mountains, whose young are full-formed at birth, as are those of all mammals; yet during fœtal life they possess exquisitely feathered gills and will swim about in water, if they are secured during fœtal life. During adult life they never live in water. Lewes remarks that "obviously this aquatic organization has no reference to the future life of the animal, nor has it any adaptation to its embryonic condition; it has solely reference to ancestral adaptations; it repeats a phase in the development of its progenitors."[2]

In snakes one lobe of the lungs is rudimentary. In birds' wings the tip of the bony structure is like a rudimentary digit; the smaller hind toe of birds is a similar case. In some species, like the ostrich, the whole wing is rudimentary. The eyes of blind fishes and other cave animals are rudiments proclaiming a former power which is now inoperative. The dew-claws of cattle and hogs, the splint-bone of horses, are rudimentary toes, and tell the story of their five toes once necessary to existence. Whales now have no hair, but rudiments found in the skin show that their ancestors were hairy. They now have no legs, but the vestigial legs reveal their four-legged ancestry. Plants have degenerate petals and spines that illustrate the same features. There are also many rudimentary psychic traits shown by animals. Many dogs turn around several times before lying down to sleep at night. Cats tormentingly play with their prey

[1] *Origin of Species*, p. 467.
[2] Darwin's *Origin of Species*, p. 468.

after it is captured, and domestic dogs still bury food—though it is no longer necessary to do so.

We find amphibians in all stages of transition, some having only just begun to emerge, while in others the transition is so nearly complete that their former identity is scarcely discernible. In embryonic or tadpole life, all amphibians possess gills for extracting oxygen from the water, and organs for water locomotion. It is only when they reach an adult stage that they possess organs which equip them for terrestrial existence.

Retrogressions.—But there have been many retrogressions in the process. Many animals after rising step by step above the fishes, and through the back-boned animals until they reached a rank only a little below the pinnacle, for some reason have gone back to the sea. The French song says, "*On revient toujours a ses premiers amours.*" Among those that have completely forsaken the land and assumed such fish-like characters as almost to elude detection are the whales, porpoises, and dolphins. Their fish-like forms and marine habits seem to indicate affinities with the fishes. But their internal structures, breathing, and mode of reproduction and suckling the young, proclaim their mammalian kinship. They resemble quadrupeds in their internal structure and in some of their appetites and affections. Like quadrupeds they have lungs, a midriff, a stomach, intestines, liver, spleen, and bladder. The organs of generation and the heart are quadrupedal in structure. "The rudimentary teeth of the whale-bone whales, which never come into use, are final links in the chain of evidence," says Professor Oskar Schmidt,[1] "that the whale-bone whales are the last members of a transformed group which commenced with animals with four toes and numerous teeth, and which by the gradual diminution of the dentition, have become whale-bone whales." The fins still retain the bones of the shoulder, fore-arm, wrist, and fingers, though they are all enclosed in a sac and could render no service except in swimming. The head is, also, mammalian save in shape, which has become modified and fish-

[1] *The Mammalia*, p. 248.

shaped for easier propulsion in the water. The mammalian skull, with all the bones in their proper anatomical relations to one another, is still preserved. Professor Schmidt says,[1] in regard to the dolphin, that "hind limbs like those of the Sirenians have disappeared externally without leaving a trace of their former existence; the rudimentary pelvic bones that are concealed in the flesh—sometimes with the last remnant of the thigh bone, very rarely with the shank,—bear witness, however, to their having possessed ancestors with four legs."

Transformations in Process.—There are several species of animals that exhibit the transformation still in process. Such, for example, is the polar bear, which is about half aquatic. This animal really gave us the first hint that some animals may revert to water life. His body, much longer and more flexible than that of common bears, enables him to adapt himself to locomotion in water. His feet have become decidedly broad, his head pointed and his ears small, thus enabling him to propel himself through his aqueous habitat with ease. Other bears hug their prey, while this one uses teeth and claws entirely. The soles of his feet have become provided with long hair, which protects against slipping on the ice. He has largely lost his hibernating habits and fishes and hunts throughout the winter. Seals show by the shape of their skull, dentition, and mode of life that they are carnivorous animals that have adapted themselves to a life in water. Their limbs are metamorphosed into fin-like rudders. Instead of perfect fish-like tails, they have two legs flattened together, with nails on the toes. These are obvious superfluities, but remain as an inheritance from ancestors to which they once were of use. They have now become modified by the present fish-like habits of the animal.

Human Recapitulation.—The various stages of man's physical development resemble so closely many existing and extinct forms of lower animal life that apparently we need but to apply the general law of evolution to say that the individual human being recapitulates in a general way the historical stages of the de-

[1] *Op. cit.*, p. 250.

velopment of the race. Man, like all other animals, begins life as a unicellular organism. Many stages, moreover, correspond very closely to animals living in an aqueous medium.

The essential stages of human development resemble those of other animals. The main difference is that the human embryo goes away beyond all others in its unfoldment. But so close are the resemblances among the earlier embryonic stages that the differences are almost unrecognizable. Some one has said that for some time no one would be able to tell whether a given embryo might turn out a frog or a philosopher. Romanes says that when man's "animality becomes established, he exhibits the fundamental anatomical qualities which characterize such lowly animals as polyps and jelly-fish. And even when he is marked off as a vertebrate, it cannot be said whether he is to be a fish, a reptile, a bird, or a beast. Later on it becomes evident that he is to be a mammal, but not till later still can it be said to which order of mammals he belongs." [1]

Evidences.—There are several lines of evidence which give such abundant proofs of man's more humble ancestry that little doubt of it remains in the minds of scientists. Chief among these on the physical side are the proofs afforded by embryology, morphology, paleontology, and pathology.

Drummond wrote: [2] "The human form does not begin as a human form. It begins as an animal; and at first, and for a long time, there is nothing wearing the remotest semblance of humanity. What meets the eye is a vast procession of lower forms of life, a succession of strange inhuman creatures emerging from a crowd of still stranger and still more inhuman creatures; and it is only after a prolonged and unrecognizable series of metamorphoses that they culminate in some faint likeness of him who is one of the newest yet one of the oldest of created things."

So close is the resemblance among the embryos of different classes of animals that Von Baer himself was unable to distin-

[1] *Darwin and After Darwin*, I, 119.
[2] *The Ascent of Man*, p. 66.

guish unlabelled specimens of the embryos of a reptile, a fish, and a mammal in their early stages of development. Professor His, one of the most expert of embryologists, on viewing a slightly abnormal embryo, known to be a human one, "asserted roundly that Krause (who had shown it) must have made a mistake, and that his specimen was a chick embryo and not a human one at all." [1]

Huxley wrote: [2] "Without question, the mode of origin and the early stages of the development of man are identical with those of the animals immediately below him in the scale. . . . Indeed it is very long before the body of the young human being can be readily discriminated from that of the young puppy; but, at a tolerably early period the two become distinguishable by the different forms of their adjuncts, the yelk-sac and the allantois. . . . But exactly in those respects in which the developing man differs from the dog, he resembles the ape. . . . So that it is only quite in the later stages of development that the young human being presents marked differences from the young ape, while the latter departs as much from the dog in its development as the man does. Startling as this last assertion may appear to be, it is demonstrably true, and it alone appears to me sufficient to place beyond all doubt the structural unity of man with the rest of the animal world, and more particularly and closely with the apes."

Wallace has added in commenting upon the above: "A few of the curious details in which man passes through stages common to the lower animals may be mentioned. At one stage [of human embryonic growth] the os coccyx projects like a true tail, extending considerably beyond the rudimentary legs. In the seventh month the convolutions of the brain resemble those of an adult baboon. The great toe, so characteristic of man, forming the fulcrum which most assists him in standing erect, in an early stage of the embryo is much shorter than the other toes, and instead of being parallel with them, projects at an

[1] Marshall, *Biological Lectures and Addresses*, p. 250.
[2] *Man's Place in Nature*, p. 89.

angle from the side of the foot, thus corresponding with its permanent condition in the quadrumana. Numerous other examples might be quoted, all illustrating the same general law." [1]

Recapitulation in the Nervous System.—The development of the central nervous system at different stages of the human

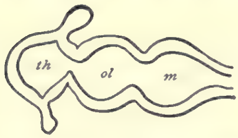

FIG. 23.—Sub-fish-like stage.

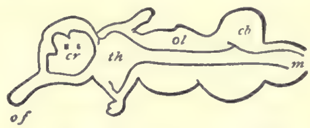

FIG. 24.—Fish-like stage.

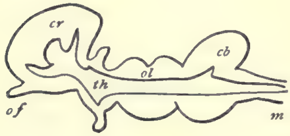

FIG. 25.—Reptilian-like stage.

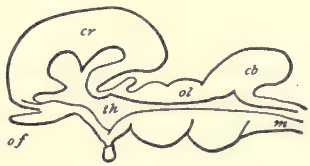

FIG. 26.—Bird-like stage.

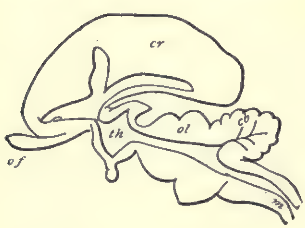

FIG. 27.—Mammalian-like stage.

FIG. 28—Human stage.

PLATE SHOWING SUCCESSIVE STAGES IN THE DEVELOPMENT OF THE HUMAN BRAIN. (AFTER LE CONTE.)

In Figs. 23–28: *th*, thalamus; *ol*, optic lobe; *m*, medulla; *cr*, cerebrum; *cb*, cerebellum.

embryo exhibits close homologies to those in some of the great groups of lower animals. Man's brain passes through a series of stages of interesting complexity. These stages are only temporary in the human embryo, while they represent the maximum development of the group corresponding to such stage.

[1] *Darwinism*, p. 449.

Professor H. DeVarigny says: "One may easily detect in the evolution of the human brain a state corresponding to that of the brain of fishes; but while the fishes permanently retain this brain structure, an advance occurs in man, and the brain acquires characters of the reptilian encephalon; later on it progresses again, and acquires bird characteristics, and finally it acquires those characters which are peculiar to mankind. Here again ontogeny demonstrates phylogeny." [1] The accompanying diagrams (Figs. 23 to 28) show the successive stages of growth through which the human brain passes. No other system of organs illustrates the idea of recapitulation quite so well.

Vestigial Structures in Man.—In the human body there are numerous obsolescent organs, which persevere in form only, and give unequivocal evidence of former ancestry. There are in all upward of one hundred and thirty that have been discovered. The vermiform appendix is one of the best-known. It is relatively better developed at birth than later. The muscles by means of which the external ear is moved are demonstrable only in exceptionally atavistic individuals. The *panicules carnosis*, or muscles by means of which animals move the skin, still exhibit vestiges of former function in man. Club-feet are said to be atavistic reminiscences of remote ancestors, meaning no more nor less than baboon feet.

"Prominent among these vestigial structures, as they are called, are those which smack of the sea. If embryology is any guide to the past, nothing is more certain than that the ancient progenitors of man once lived an aquatic life. At one time there was nothing else in the world but water-life; all the land animals are late inventions." After emerging from the annelide and molluscan stages, what was to become man remained in the water until evolution had produced a fish-like stage; "after an amphibian interlude he finally left" the watery domain, but "many ancient and fish-like characters remained in his body to tell the tale." [2]

[1] DeVarigny, *Experimental Evolution*, p. 35.
[2] Drummond, *The Ascent of Man*, p. 83.

Dr. Brooks asserts[1] that: "We may feel sure even in the absence of sufficient evidence to trace their direct paths, that all the great groups of metazoa ran back to minute pelagic ancestry."

One typical vestigial structure which dates back to sea ancestry is the *plica semi-lunaris*, or the remnants of the nictitating membrane of fishes. It is a semi-transparent, curtain-like membrane formed on the inner side of the eyes as a vertical fold of the conjunctiva, which apparently is of great utility in sweeping across the eye to cleanse it. It is very common among birds, some fishes, reptiles, amphibians, and most vertebrates. In man there is only a small fold or curtain draped across one side of the eye, and Romanes states that it is only rudimentary in all animals above fishes.

The most unequivocal rudimentary structures which give indication of water ancestry are the visceral clefts or gill-clefts in the neck-region. These were the first discovered vestigial structures to indicate the probable line of descent. These structures are first seen in the amphioxus, the connecting link between invertebrates and vertebrates. "In all water-inhabiting Vertebrates which breathe by means of gills, the thin epithelial closing plates break through between the visceral arches, and indeed in the same sequence as that in which they arose. Currents of water, therefore, can now pass from the outside through the open clefts into the cavity of the alimentary canal and be employed for respiration, since they flow over the surface of the mucous membrane. There is now developed in the mucous membranes, upon both sides of the visceral clefts, a *superficial, close* network of blood-capillaries, the contents of which effect an exchange of gases with the passing water. . . . Likewise in the case of the higher (amniotic) Vertebrates, both inner and outer visceral furrows, together with the visceral arches separating them, are . . . formed; but here they are never developed into an actually functioning respiratory apparatus; they belong consequently in the category of rudimentary organs. Upon the mucous membrane arise no branchial leaflets; indeed the

[1] *The Genus Salpa*, p. 159.

formation of open clefts is not always and everywhere achieved, since the thin epithelial closing membranes between the separate visceral arches are preserved at the bottom of the externally visible furrows." [1]

The number of gill-clefts and visceral arches decreases in the ascending scale of vertebrate life. In some of the lower species, as the selachians, there are seven or eight, while birds, mammals, and man possess but four. The number of external openings also is found to decrease constantly as we ascend the scale of life. In the higher mammals and man they would scarcely be known were it not for their detection in the embryonic stage. But they are discernible in the chick embryo in the third day of incubation, and they may be seen distinctly in the human embryo according to His, when the embryo has attained a length of three or four millimetres. They begin to become obliterated by the fourth week of fœtal life. But still, says Drummond,[2] "so persistent are these characters (the gill-slits) that children are known to have been born with them not only externally visible—which is a common occurrence—but open through and through, so that fluids taken in at the mouth could pass through and trickle out at the neck. . . . Dr. Sutton has recently met with actual cases where this has occurred.[3] . . . In the common cases of children born with these vestiges the old gill-slits are represented by small openings in the sides of the neck and capable of admitting a thin probe. Sometimes even the place where they have been in childhood is marked throughout life by small round patches of white skin." Dr. Hertwig also mentioned the fact that fistulæ, which penetrate from without inward for variable distances, sometimes even opening into the pharyngeal cavity, are to be met with in human beings. These are explainable as being still open clefts of the cervical sinus.

The ultimate metamorphosis of the embryonic gill-clefts is still a question of much interest. There is little doubt that the

[1] Hertwig-Mark, *Text-Book of Embryology*, p. 286.
[2] *Ascent of Man*, p. 86. [3] Sutton, *Evolution and Disease*, p. 81.

thymus, and probably the thyroid gland, are derived from the visceral clefts. The thymus is derived, according to Kölliker, Born, and Rabl, from the third visceral cleft. Some authorities, among them DeMeuron and His, differ in minor points, principally as to the number of clefts involved, but in the main agree. The thymus is found in all animals beginning with the fishes. Even in the fishes it is derived from epithelial tracts of the open gill-clefts still functionally active. Dohrn holds that the thyroid gland is the remnant of ancient gill-clefts of the vertebrates. Although this is disputed by Hertwig, he still admits that "It appears to be an organ of very ancient origin, which shows relationship to the hypobranchial furrow of Amphioxus and the Tunicates." [1] It at any rate gives strong evidence of the close relationship, being developed "from an unpaired and a paired evagination of the pharyngeal epithelium," and in the region of the former visceral clefts, and by good authorities claimed to be developed from them. The so-called accessory thyroid gland is conceded by all to have thus arisen. The unpaired fundaments which contribute toward the thyroid are not wanting in a single class of vertebrates. Dohrn makes several bolder hypotheses concerning the metamorphosed products of the embryonic clefts. He maintains, "(1) that the mouth has arisen by the fusion of a pair of visceral clefts, (2) that the olfactory organs are to be referred to the metamorphosis of another pair of clefts—a view which is also shared by M. Marshall and several others—(3) that a disappearance of gill-clefts on the region of the sockets of the eye is to be assumed, and that the eye-muscles are to be interpreted as remnants of gill-muscles." [2] Hertwig, however, dissents from some of these views. But most embryologists are agreed that the middle and outer ear are derived from the upper portion of the first visceral cleft and its surroundings. In fishes there is no external auditory apparatus, and these organs, which in man develop into an ear, subserve another purpose. The Eustachian tube represents a partial closure of an original cleft;

[1] Hertwig-Mark, *Text-book of Embryology*, p. 317.
[2] Hertwig-Mark, *op. cit.*, p. 288.

the tympanic membrane is developed from the closing plate of the first visceral cleft and surrounding portions of the arches; and the external ear is derived from the ridge-like margins of the first and second visceral arches. Drummond says:[1] "Ears are actually sometimes found bursting out *in human beings* half-way down the neck in the exact position—namely, along the line of the anterior border of the sterno-mastoid muscle—which the gill-slits would occupy if they still persisted. In some families, where the tendency to retain these special structures is strong, one member sometimes illustrates the abnormality by possessing the clefts alone, another has a cervical ear, while a third has both a cleft and a neck-ear—all these, of course, in addition to the ordinary ears."

Marshall asserted that "Rudimentary organs are extremely common, especially among the higher groups of animals, and their presence and significance are now well understood. Man himself affords numerous and excellent examples, not merely in his bodily structure, but by his speech, dress, and customs. For the silent letter *b* in the word "doubt," the *g* in "reign," or the *w* in "answer," or the buttons on his elastic-side boots, are as true examples of rudiments, unintelligible but for their past history, as are the ear muscles he possesses, but cannot use; or the gill-clefts, which are functional in fishes and tadpoles, and are present, though useless, in the embryos of all higher vertebrates; which in their early stages the hare and tortoise alike possess, and which are shared with them by cats and by kings."[2]

Survival Movements.—An exceedingly interesting and important study, and one which sheds much light upon the theory of recapitulation, was carried out by Dr. Alfred A. Mumford of England.[3] He noticed the peculiar paddling or swimming movements which a babe only a few days old made when placed face downward with only hands and feet touching the floor, its head and abdomen being supported by a hand placed

[1] *Ascent of Man*, p. 89.
[2] Marshall, *Biological Lectures and Addresses*, p. 209. [3] *Brain*, 1897.

under each. Being struck with the great similarity of these movements to those made in propulsion through a watery medium, he began a systematic study of infants' movements. Besides confirming and extending many of the recent observations concerning an anthropoid relationship, he makes statements which are much more far-reaching. He has noticed that the limbs at birth and during the first few weeks of infancy tend to assume the primitive developmental position, viz., "folded across the chest, thumb toward the head and with the palm toward the thorax; but more often the palm is away from the chest-wall and is directed anteriorly by means of extreme pronation, the dorsum of the hand often lying on or near the shoulder, sometimes an inch or two outside. As the child wakes up, the elbows begin to open out and the palm is pushed outward in a way that would be useful in locomotion, especially in a fluid medium. In fact, it is the movement of the paddle." These movements are described as slowly rhythmical movements of flexion and extension such as one sees among animals in an aquarium. They occur often in series of three at a time during a quarter of a minute, followed by alternating pauses. These are interpreted as vestigial movements of a former amphibian existence, which were of fundamental importance before fore-limbs developed. This is supplanted by the shape of the hand, which is one of the most highly developed of bodily organs in function but in some respects least modified of all the skeleton. "In shape and bones it is more like the primitive amphibian paddle than is the limb of any other mammal."

Other Infant Atavisms.—The spinal column of the child exhibits only two curves at birth and does not represent a truly human vertebral column. "When the child is born, the curvature of its spine in the dorso-lumbar region approximates to that of an ordinary quadruped in which there is no lumbar convexity, so that the spine in that region presents one continuous curve concave forward. For some time after birth the infant retains the quadrupedal character of the spinal curve in the dorso-lumbar region, and, as it acquires nervous and muscular

power and capability of independent movement, its mode of progression in the early months by creeping on hands and knees approximates to that of the quadruped. It is only after it has attained the age of from a year to sixteen months that it can erect its trunk, completely extend the hip and knee joints, and draw the leg into line with the thigh, so as to form a column of support, which enables it to stand on two feet." . . . The human characteristics "are acquired after birth, and are not imprinted on the human spine from the beginning, though the capability of acquiring them at the proper time is a fundamental attribute of the human organism." [1]

Grasping Movements.—It is a noteworthy fact that in early infancy the child in grasping an object in the hand does not clasp it with the thumb opposed to the fingers. The same is true of the apes. The thumb of monkeys is of comparatively little use and some species lack the muscle which gives control. Women, who are more primitive than men, in doubling their fists, frequently do not clinch the thumb over the fingers. Children double the fists similarly.

Dr. Louis A. Robinson made an instructive study of the instinctive power which new-born infants display in grasping a finger or a stick placed in their fingers. So tightly did the babes grasp objects that he tested them to discover their power of grip and strength of arm. In over sixty cases tested within an hour after birth he found that with two exceptions they could sustain their whole weight for at least ten seconds, and several held on for nearly a minute. At four days of age when strength had increased, nearly all could sustain their weight for a minute. At two weeks several hung for two minutes, and at three weeks one held on for two minutes and thirty-five seconds. This function dies out soon, either from lack of exercise or because of the natural decadence of the instinct—doubtless both.

Photographs of infants show that "Invariably the thighs are bent nearly at right angles to the body, and in no case did the lower limbs hang down and take the attitude of the erect posi-

[1] Sir Wm. Turner, *Nature*, vol. 56, p. 427.

tion.[1] This attitude and the disproportionately large development of the arms," Robinson says, "compared with the legs, give the photographs a striking resemblance to a well-known picture of the celebrated chimpanzee 'Sally' at the Zoological Gardens. . . . The young orangs and chimpanzees that they have had at the Zoological Gardens slept with the body semi-prone and with the limbs, or all except one arm, which was used as a pillow, curled under them. This is exactly the position voluntarily adopted by eighty per cent. of children between ten and twenty months old, which I have had opportunities of watching. I was told by the attendants at the Zoological Gardens that no ape will sleep flat on his back, as adult man often does."

Dr. Robinson also noted the probably atavistic tendencies of children in the peculiar sleeping postures which they often select when unrestricted by clothing. They frequently sleep curled up, and often face downward, with the limbs flexed under them. Savages not infrequently adopt the same sleeping positions. These positions resemble those adopted by the simian apes. Robinson further recites that "probably the readiness with which infants play at 'bopeep' and peer round the edge of a cradle curtain, and then suddenly draw back into hiding, is traceable to a much earlier ancestor. Here we see the remains of a habit common to nearly all arboreal animals, and the cradle curtain, or chair, or what not, is merely a substitute for a part of the trunk of a tree behind which the body is supposed to be hidden, while the eyes, and as little else as possible, are exposed for a moment to scrutinize a possible enemy and then quickly withdrawn."

Psychic Reverberations.—Genetic psychology is tracing out the gradual growth of mental powers and processes; philology shows us that many forms of speech become useless, are dropped off, and new ones are coined to meet new conditions; history, sociology, and archæology reveal former social customs and relations that are now obsolete, and sociology points out new

[1] "Darwinism in the Nursery," *Nineteenth Century*, 1891, vol. 30, pp. 831–842.

customs and laws in the making. We cannot hope to unravel all of man's mental history with any such demonstrable certainty as we can reconstruct his past physical history. Mental states are the most plastic, variable, fleeting, and the least preservable entities, and although we must logically conclude that the record of our psychoses is never effaced, yet the majority become so intricately blended and interwoven with other more recent acquisitions that no psychology will ever be able to reconstruct the entire race history. Only the most oft-repeated and most far-reaching psychic acts leave traceable evidences.

But just as all psychic vestiges are less evident than physical, so rudimentary psychic phenomena are less capable of proof than vestigial physical structures. There is, however, unquestioned evidence of numerous rudimentary psychic traits, and many others which though not capable of rigorous demonstration, give strong evidence of their origin. Only the general faculty or power is transmitted and not particular forms of knowledge. Nature provides the potentiality for reactions, nurture largely determines what these shall be. Moreover, embryonic life while furnishing the main clews to physical recapitulation, gives meagre evidence of any corresponding mental retracement. Of prenatal psychoses we know little. The only evidences are the simplest muscular reactions to mechanical and thermal stimuli. Thus while the physical retracement from the lowest unicellular structure to the distinctly human form has been accomplished and made evident during prenatal existence, there is no evidence of any mentality above the purely vegetative reactions such as might be observed in the lower forms of animal life. Again, when mental life is launched at birth it is of the distinctly human type.

Traces of peculiar manifestations of the minds of our remote ancestors are to be met with in "the present reactions of childish and adolescent souls, or of specially sensitized geniuses or neurotics." There are also times in the life of the normal individual when the control maintained by the higher and more recently acquired centres is apparently suspended and the lower and

older centres there given full sway seem to step in and the resulting psychical phenomena present traces of long-past activities. Such conditions are evidenced in sleep and dreams. Idiots present childish and even animal mentality, showing that the higher centres have failed to function. Instead of evincing rudimentary psychic phenomena in the true sense, they are cases of arrested development. Their lives are made up of those activities that are common to animals and humanity in its infancy. Again, certain modes of thought crop out in the form of omens, superstitions, sayings, proverbs, and signs, to which we ordinarily attach no importance, but often hear and repeat. All these have a meaning to the psychologist. They are to him vestigial or rudimentary organs and suggest use in a remote past. "Few things," says Black, "are more suggestive of the strange halts and pauses which mentally a people makes than to note how superstition springs up in the very midst of modern education." [1] They are to the psychologist what gill-slits are in pathological cases of arrested development. Children are very prone to superstition, which is also true of savages.

Inherited Memories.—The range of atavistic psychoses is practically unlimited. Admitting memory to be a biological fact, we assume that every impression leaves an ineffaceable trace, by which we mean that vestiges or predispositions or habit-worn paths of association are formed which will function again when properly stimulated. Conservation of impressions is a state of the cerebral organism. The effect once produced by an impression upon the brain, whether in perception or in a higher intellectual act, is fixed and there retained. The retention of any act in memory, according to James, is an unconscious state, purely physical, a morphological feature. According to Ribot,[2] we may assume that persistence of memories "if not absolute, is the general rule and that it includes an immense majority of cases." This, of course, applies only to the persistence of memories during the individual's life, but as Dr. Hall

[1] *Folk Lore in Medicine*, p. 218.
[2] *Diseases of Memory*, p. 185.

has pointed out:[1] "We may fancy, if we like, that on some such theory as, *e. g.*, Mach's of hereditary or a form of memory by direct continuity of molecular vibration in cells or their elements (Weismann's biophors, Wisner's plasomes, deVrie's pangens, Nägeli's micellæ, etc.), or in any less material way," these traces or vestiges are continued and may, even though apparently forever effaced, reappear in future generations in children or pathological cases. Multitudes of impressions, even in the individual's existence, may never be recalled, but they might be if the proper stimulus occurred, or if more recent memory modifications were removed and the older memories, as it were, set free. Evidence in support of such a theory is furnished by pathological cases. Events long since apparently forgotten often reappear in disease. This is accounted for by the destruction of the more recent and higher centres. According to Ribot, the law of regression is that a progressive dissolution of the memory proceeds from the least-organized to the best-organized, from the new to the old. In physiological terms, degeneration first affects what has been most recently formed, because it has not been repeated so often in experience. Hence, may not such cases give us glimpses of the remote psychic past, even of the paleopsychic age?

Short Circuits.—A consideration of the correspondence between ontogeny and phylogeny shows that nature has short-circuited many processes. Each individual no longer retraces the entire, long, circuitous route traversed by his ancestors. Not only have many steps been omitted but many improvements have been devised. Just as the palace-car has superseded the ox-cart, many organs and functions, both physical and mental, have been evolved to meet the exigencies of modern life. Similarly the individual starts life with primitive, relatively undifferentiated and unspecialized organs; but the swim-bladders give way to lungs, the one-chambered heart becomes quadruple, the notochord disappears and the spinal column develops with its wonderful arrangement for protecting the still more wonderful

[1] *American Journal of Psychology*, 8, 173.

brain. In the course of climbing up its own genealogical tree, the human being leaves behind perhaps thousands of structures which were necessary to particular stages of existence but which become excised or functionally obsolete as the higher stages are entered. Some hundred and thirty of these vestigial structures have been discovered in man's body.

To preserve all useless structures would be a waste of energy and material, and nature is never prodigal. The laws of use and disuse are ever operative, causing the development of some characteristics and the atrophy and elimination of others. As soon as structures lose their functions they tend gradually to disappear. If detrimental they are the sooner dropped off. The vestigial or obsolescent structures which come regularly under our notice in any class of individuals are undoubtedly those which subserve some unknown purpose during embryonic life, or they are such as have only recently ceased to function. Those that appear occasionally, but are absent in the normal individuals, are probably the reverberations of long-since abandoned organs. They have become reawakened through stimulations that have called forth functions similar to those possessed by the organs in question, or they may belong to arrested development. To this class many pathological freaks and abnormalities may undoubtedly be referred. Romanes says that "the foreshortening of developmental history which takes place in the individual lifetime may be expected to take place, not only in the way of condensation, but also in the way of excision. Many pages of ancestral history may be recapitulated in the paragraphs of embryonic development, while others may not be so much as mentioned."

It is worthy of further note also that many of the preceding stages in a given line of existence have never been discovered by embryology. It was only through paleontology, which gathered up the fossil remains, arranged them in series, and then spelled out the line of ascent, that they were discovered. By a process of reasoning it was then determined that probably the same general story could be traced in the embryo. Many of the characters

found analogies in the embryos, but still a great many have never been found and it should not be expected that they will be found. No human embryo has been found that could be called a fish, but in all human embryos there are characteristics which are very similar to those possessed by a fish. But the real fish has in addition many more, which are peculiar to its species alone. So also at the fish-like stage the human embryo has characteristics and potentialities (hidden, it may be) all its own. The courses of development of the fish and man may have been, probably were, very similar up to a certain point, and then they diverged, each adding and eliminating such as were necessary for its own advancement. Thus animals that had originally the same progenitors may have become widely divergent, so much so that even their embryological features in their higher stages are entirely different. Though man starts life as a unicellular organism, there is no time when this organism is an amœba or any other known animal. Though it may so closely resemble an amœba as to be indistinguishable from one, yet we must admit that it possesses differences, dynamic relations, probably morphological differences if we had power to discern them, which mark it off from everything else.

Recapitulation Incomplete.—The parallelism is inexact, *i. e.*, recapitulation is not perfect. Although the animal may have passed through stages which have been demonstrated by paleontology, the exact parallelism cannot be detected by embryology, showing that some stages have dropped out and others been added. Cope says: "It is nevertheless true that the records brought to light by embryologists are very imperfect, and have to be carefully interpreted in order to furnish reliable evidence as to the phylogeny of the species examined. An illustration of this is the fact that the species characters appear in many embryos before those which define the order or the family, although it is certain that the latter appeared first in the order of time. Most of the important conclusions as to the phylogeny of Vertebrata demonstrated by paleontology have never been observed by embryologists in the records of the species studied by

them. Thus I have shown that it is certain that in the amniote vertebrates the intercentrum of the vertebral column has been replaced by the centrum; yet no evidence of this fact has been observed by an embryologist. If we could study the embryonic development of the vertebral column of the Permian or Triassic Reptilia, the transition would be observed, but in recent forms cænogeny has progressed so far that no trace of the stage where the intercentrum existed can be found."[1]

Marshall in maintaining that recapitulation is not perfect, shows how the embryo of a given stage of development cannot possibly represent exactly any other adult stage of existence. He says: "A chick embryo of say the fourth day is clearly not an animal capable of independent existence, and therefore cannot correctly represent any [adult?] ancestral condition, an objection which applies to the developmental history of many, perhaps of most animals." The record is "neither a complete nor a straightforward one. It is indeed a history, but a history of which entire chapters are lost, while in those that remain many pages are misplaced and others are so blurred as to be illegible; words, sentences, or entire paragraphs are omitted, and, worse still, alterations or spurious additions have been freely introduced by later hands, and at times so cunningly as to defy detection."[2]

Further, "it is quite impossible that any animal, except perhaps in the lowest zoological groups, should repeat all the ancestral stages in the history of the race; the limits of time available for individual development will not permit this. There is a tendency in all animals toward condensation of the ancestral history, toward striking a direct path from the egg to the adult. This tendency is best marked in the higher, the more complicated members of a group—*i. e.*, in those which have a longer and more tortuous pedigree."[3]

Hall, who has promulgated the theory of recapitulation more than any other writer, says: "It is well to remember that from

[1] *Primary Factors of Organic Evolution*, p. 209.
[2] *Biological Lectures and Addresses*, p. 306.
[3] *Ibid.*, p. 311.

a larger biological view, every higher animal is not only composed of organs phyletically old and new, but that the order of their development may even be changed. Basal and lapidary as is the great biogenic law that the individual recapitulates the growth stages of his race, the work of Appel, Keibel, Mehnert, and many others has demonstrated abundant inversions of it. The heart, *e. g.*, in the individual develops before the blood-vessels, but this reverses the phylogenetic order. The walls of the large vessels develop before the blood-corpuscles, while the converse was true in the development of the species." [1]

See *The American Journal of Psychology*, vol. X, Jan., 1899, article on "Hydro-Psychoses," for a fuller discussion by the author of the subject of recapitulation.

[1] *Adolescence*, I, p. 55.

CHAPTER V

EDUCATIONAL SIGNIFICANCE OF RECAPITULATION

Education Should Follow Nature.—All the foregoing is extremely suggestive for education. It argues for an opportunity for the retracement of hereditary endowments and against forcing nature. It is equally important to argue against keeping the child so long in any stage as to produce arrest. Furthermore, progress is indicated by the fact that present generations remain so briefly in the lower types of structures and pass rapidly on to higher forms. This shows that nature causes each generation to select that which is vital and fundamental from the past and then builds upon that. What is proved to be of enduring worth is seized upon and made relatively permanent in the race. Here is the origin of instincts and the structures necessary to their functioning.

Life means successive change, modification, and selection of the most adaptable. Education is life and educative means should seek to work in harmony with the original plans of nature. At the same time we must not forget that the school and other educative means are included in nature. We should cease to say "man and nature"; man is the highest product of nature. Nature study is incomplete without a study of man. Educative means should represent the *summum bonum* in nature, and like more primitive nature, they should select the best for cultivation and preservation. Here selection should be conscious and intelligently purposive.

In addition to merely selecting the best traits and increasing their power through wise cultivation, the school should set up conscious ideals toward which the efforts of the school in cooperation with the individual are to be directed. By this means

the school becomes the highest instrument of evolution. By this means short circuits are produced and the individual is assisted without danger and in the most economical method to higher planes. The doctrine of recapitulation teaches how we may conserve the best, eliminate the undesirable, and lead to higher and higher development. It is a doctrine of promise and of hope!

Immutability of Mental Laws.—The theory of recapitulation re-enforces the idea that natural laws prevail in the mental world as in the physical. The popular mind in general has become accustomed to regarding physical occurrences as the result of natural laws. The idea of chance and superstitions regarding supernatural physical events are largely displaced by rational ideas of cause and effect. But scientific intelligence has not become so general regarding biological facts and changes, and still less so concerning mental phenomena. It is highly important that growth processes, both physical and psychical, should be understood as phenomena which are absolutely conditioned by laws as immutable as those governing the falling of a stone. It is only since a knowledge of the absolute relation between causes and effects has come to be understood and heeded in medicine that a science of healing has been made possible. Until it was accepted without reservation the physician was not much more than the "medicine man" dealing in charms, incantations, and sorcery. Until the same rational view comes to obtain concerning mental phenomena we cannot have a science of education, but must be enthralled by the veriest quackery.

Springs of Conduct.—Lloyd Morgan [1] wrote: "It must not be forgotten that, according to the view here adopted, all our instincts and all the more permanent traits of human character have been formed under the guidance of natural, individual, and social selection; such habits as were for the good of the species, crystallizing, or rather organizing, into instincts or permanent traits of character; such as were detrimental quietly dying out. Or, again, we may say that these instincts and traits of character

[1] *Springs of Conduct*, p. 260.

have been formed under the more general influence of the uniformity of Nature. Let me not be misunderstood here. The *conception* of the uniformity of Nature is one of late development; but the *influence* of the uniformity of Nature is dominant in every mental as it is in every physical process, mind being throughout its development moulded in conformity with an orderly external sequence of events."

Morgan seeks to trace the origin of the impulses which issue in our various types of conduct. He also attempts to trace the origin of our states of cognition, feeling, and volition. He shows conclusively that no act of conduct is simple, self-initiated, and complete in itself. It takes the doctrine of recapitulation to explain their origin and effects. He writes [1] that, "just as, in the adult, impressions of sensation or relation recall faint representations of other similar impressions acquired during childhood, which we call memories, so also, in the child, impressions of sensation or relation will recall faint representations of impressions acquired during the childhood of the race, which we may call *inherited* memories. Innate ideas, and so-called *à priori* truths, are such inherited memories; and though it is probable that *in* the individual they are only developed by impressions gained ultimately through the senses, just as characters written in invisible ink are only developed by the heat of a fire, it may be taken as certain that they are not acquired *by* the individual. But of what, it will now be asked, are these ancestrally acquired ideas the memories? To this question, it seems to me, there is but one answer. They are the inherited memories of impressions gained proximately or ultimately through the medium of sense. . . . And just as innate ideas are to be regarded as the result of ancestral experience transmitted to us by inheritance, so, too, are innate emotions and desires the result of ancestral experience transmitted to us by inheritance. In the one case, as in the other, the individual *education* of experience *educes* or 'draws' out those products of ancestral acquisition which were lying latent in our organization and in our character."

[1] *Op. cit.*, p. 31.

Recapitulation Not Fatalistic.—This is not to be construed as a doctrine of fatalism, at least not in that tabooed philosophical sense in which the individual regards himself as a creature of fate over which he has no control or guidance. It is here maintained that one's possibilities are largely determined by hereditary bequests, that nature is more potent than nurture in determining capacity, but the environment of the individual and his own self-activity largely decide what advantage shall be taken of nature. The adult individual almost entirely and the child to some degree even determine what the environment shall be. The discussions of heredity, instinct, memory, and volition will consider this subject much more fully.

Recapitulation, History, and Prophecy.—The study of recapitulation is of no small importance in a philosophy of education. Though a study of phylogeny does not show that the individual recapitulates the whole history of the race, yet it does reveal analogies and retracement in the main features. Because of the close correspondence between ontogeny and phylogeny, a study of racial development helps us to interpret and, as we have seen, even to predict individual development. It also helps us to understand better the meaning of the many transitory forms and psychoses that manifest themselves.

Recapitulation Suggests Order of Development.—In the discussion of instinct, and also memory and heredity, it is shown that ancestral traits are reproduced in subsequent generations. It is a question of much importance to determine the order in which various physical and mental characteristics arise in the individual. To adapt instruction and activity to the needs and capacities of the growing individual is a problem of prime importance to education. Because of great individual variations we cannot determine the exact time of the development of any activity, but the order on broad lines is quite fixed. For example, we cannot tell at what month a given child will learn to talk, but we know that speech is developed in all children in practically the same order. Single isolated words which represent sentences are first acquired; nouns are learned before adjectives; prepositions and

conjunctions are learned late; the complex sentence is seldom used or understood before the child goes to school; walking is usually acquired before talking; speech and right-handedness develop together. Large muscles develop before finer ones; perception and memory are well developed before reasoning; feelings develop before emotions; the child is will-less and unmoral for a long time after birth, though memory and perception are very acute, etc.

Larval Stages Must Precede Higher.—The normal development of each stage of existence is necessary for the unfolding of the next stage. It is well known that the tadpole's tail does not drop off, but is absorbed in some way during the period of the growth of the hind legs. It has been noted that if the tail is cut off the frog grows up a malformed individual. Dr. Hall, carrying the analogy into all human development, regards it as necessary for the child to pass through certain stages of physical and mental development which will not persist through life but will be moulted after having subserved their purpose. Hence his oft-quoted expression: "In education don't cut off the tadpole's tail." Sedgwick [1] lends evidence from his biological studies to the same view. He says: "Ancestral stages of structure are only retained in so far as they are useful to the free-growing organism, *i. e.*, to the larva in its free development. The only functionless structures which are preserved in development are those which at some time or another have been of use to the organism during its development after they have ceased to be so to the present adult."

From this we may learn that just as the beautiful butterfly must be preceded by the larva and the pupa, so the mature stages of human life develop out of lower and more primitive stages. Just as we are certain that the pupa will develop into the butterfly if provided with suitable environment, so we may rest assured that suitable environment will mature the larval mental and moral stages; primitive forms will be moulted and the individual will emerge full-fledged, with powers complete

[1] *Quarterly Journal Mic. Sci.*, 1894, 36: 35.

as in all others of normal development. On the other hand, just as underfeeding may dwarf the developing bee or plant, so undernutrition, physical or mental, may produce life-long malformations in the human being.

Preparatory Stages in Child Development.—Normal young children are full of animal life, and very little reflective and not at all religious. In fact, we may say that ideally their growth should be that of a healthy animal. Spirituality will appear later if the child has developed a sound physical nature. Children are little savages and this should not alarm us. They will emerge from savagery to sedate civilization in due time if we simply afford them an opportunity to work their way upward as the savage was obliged to do. Normal children represent the very acme of egoism and selfishness. They even resort to lying and fighting to obtain their selfish ends. Crotchety people who never passed through childhood naturally and who do not understand through study about epochs of development misinterpret the actions of the child and denominate him mean, sinful, wicked, and foredoomed. Could they but understand the difference between the child and the adult and did they but know that egoism properly developed is the only means of altruism, they would discipline children with far different measures. They ought to know that to repress unduly the child's egoism and his instincts of pugnacity would as effectually make a life-long weakling of him as that to save the caterpillar from struggles to secure freedom from the cocoon would forever destroy its chances of becoming a butterfly, or that to break the shell for the hatching chick would probably cause its death. Could high-school teachers only realize that the restlessness, instability, and even waywardness, which nervous, fretful teachers so much deplore, are the very signs which betoken fulness and abundance of life into which pupils are struggling to emerge, they would assume a sympathetic, directive attitude instead of the repressive measures of the martinet.

Various undesirable traits often appear in more or less marked degrees in children and youth, *e. g.*, teasing and bullying, preda-

tory traits, fighting, and running away, which cause the unwise teacher to give way to despair, thinking that such traits indicate an evil future. Could he but know that these are normal traits and that there will be a moulting period from which the individual will emerge devoid of the lower preparatory characteristics, he would have less cause for anxiety and be more able to deal intelligently with given periods. A knowledge of the facts of recapitulation should make teachers much more intelligently sympathetic with child growth and development. The teacher is eager and anxious to impress great truths upon the child mind and at the earliest moment. He wishes to make men and women immediately of the boys and girls. He is not content to wait. But nature has her own way. The teacher cannot force growth. Nature abhors precocity. The unintelligent teacher becomes discouraged with nature's ways. If he could only understand, his discouragement would be dispelled and his hopes run high. He would know that what has taken æons to develop will not easily be aborted. The teacher is not even permitted to plant the most potent seeds of ability and character. Those are hereditary endowments. The teacher's business is to recognize signs of their germination and then to provide the best means for their normal unfoldment. To force growth produces premature decay; to retard, causes arrest or degeneration. The main business of the educator during the first few years of the child's life is to provide suitable conditions for him to come into possession of his rightful hereditary endowment.

Maj. J. W. Powell, in describing man's progress,[1] has stated the idea as follows: "Every child is born destitute of things possessed in manhood, which distinguish him from the lower animals. Of all industries he is artless; of all institutions he is lawless; of all languages he is speechless; of all philosophies he is opinionless; of all reasoning he is thoughtless; but arts, institutions, languages, opinions and mentations he acquires as the years go by from childhood to manhood. In all those

[1] *From Barbarism to Civilization*, p. 97.

respects the new-born babe is hardly the peer of the new-born beast; but as the years pass, ever and ever he exhibits his superiority in all of the great classes of activities, until the distance by which he is separated from the brute is so great that his realm of existence is in another kingdom of nature."

Russell has said:[1] "The human infant is, in truth, much more on a par with the lowly marsupials, the kangaroo and opossum, and requires for a longer period even than they the maternal contact, the warmth and shelter of the mother's arms. And not only does man thus begin life at the very bottom of the ladder, but he 'crawls to maturity' at a slower pace by far than any of the animal species. Long before he reaches manhood most of the brute contemporaries and playmates of his infant years will have had their day, and declined into decrepitude or died of old age."

The Child Not a Miniature Adult.—Though human, the child possesses at birth and for a long period subsequent many traits, physical and psychical, that are so different from those he will possess when mature that they might equally well be possessed by the lower animals. It was previously noted that during pre-natal life for a long time it is difficult to distinguish the embryo from those of the lower animals. Even at birth the bodily proportions are very different from what they will be in adult life. The body and arms are ong, the legs are short, the head vastly larger in proportion to the rest of the body than it will be later. Although the head is very large, the frontal portion is relatively undeveloped, resembling the lower races or even the simians. If the body possessed the same proportions at maturity as in infancy, it would look like a monstrosity. The nervous system is very immature at birth. The frontal lobe is not only small, but the medullation of the cells is very incomplete and the association fibres necessary for relational thinking are almost entirely wanting. Not for a month after birth do the association areas of the brain begin to be medullated, and even at three months they are relatively unmedullated.

[1] Introduction to Haskell's *Child Observations*, p. xix.

Psychically the child is not a miniature adult either. Intellectually and morally he lives in a realm long ago passed over by his parents and teachers. Furthermore they have so completely moulted their childhood traits that they would not recognize themselves if an exact reproduction of their child life could be furnished them. The adult is prone to judge the child mind from his own adult plane of thought and action. Consequently every action of the child is judged by such motives as govern the adult. The child, however, lives, moves, and has his being in a realm quite apart from that of the adult. If the child is to be wisely guided it can only be through a sympathetic understanding of the given stage of development and its relation to what precedes and what follows.

General Order of Unfoldment.—In a general way, the individual traverses mentally a road similar to that passed over by the race. The earliest manifestations of mental life in the human infant seem to be mere sensory pleasure-pain reactions to stimuli such as are exhibited by low forms of animal life. They gradually develop into higher, more discriminative stages, the senses become more accurate, the child becomes imitative, but still is not strongly reflective, is selfish, uncontrolled, etc. Gradually it becomes more imaginative, reflective, volitional, social, and ethical. This briefest possible sketch represents in a general way the course of racial development as well as individual unfoldment. The order of functioning of the various senses in the individual is essentially the same as we find in viewing the ascending zoological scale.

The senses first to awaken in both cases are the tactile and chemical senses, *i. e.*, touch, taste, smell, and hunger. These are most fundamental in self-preservation. Sight and hearing in the phylogenetic series were long in developing and slow in attaining perfection. The new-born babe is deaf and blind for some time, and these senses are slow in maturing. The development of touch as compared with sight and hearing is suggestive for education. The child must have abundant opportunity to touch, "feel," and handle things and gain "first-

hand" knowledge if he is to awaken normally. Note what the blind and deaf can do by touch, if only given an opportunity.

Ear before Eye in Language.—In race evolution the ear became an instrument for language acquisition long before the eye. Until long past the Homeric age all language was transmitted by word of mouth and the ear was the receiving organ. Writing and reading are decidedly modern accomplishments. Man has only recently found it necessary to view things minutely and by artificial light. Consequently the eye is still ill-adjusted to the new order of life. A study of the child's eye shows that here ontogeny retraces phylogeny. How poorly the babe controls the finer adjustments and co-ordinations may be seen by watching any helpless babe of a few hours or days old. The two eyes do not move together and they are very unco-ordinated. The child on entering school at six still has difficulty in focusing his eyes upon minute objects like fine print. Unfortunately we have thought that book study was the very best means of mental development. We are learning better and have also learned to free the immature eye from over-exertion and to protect it against almost certain disability consequent upon its premature use. That the ear should be the means of early language acquisition, however, we have been very tardy to appreciate. Teachers must understand that little children to be taught economically and effectively must be taught orally. The child begins to read after six or more years of hearing language. For five or six years more he cannot and should not *read to learn* very much, but should master the art of *learning to read.* His period of learning to hear is comparatively short, and the time of hearing to learn appears very early. These facts should be very significant to every teacher of children.

Utility as an Incentive to Development.—Psychologists assert that the purpose of sensation is to stimulate action; that every sensation tends to awaken its appropriate response. A study of lower forms of life and of primitive man reveals the close correspondence between sensation and muscular response and the meagre power of inhibition. The child is similarly endowed to

a marked degree. Primitive man did not acquire perceptions merely for the sake of hoarding them; neither were they for his improvement in the abstract. He acquired knowledge that he might reproduce it in action—in making something or in doing something. Note the identical tendency in the child. How eager he is to learn provided he expects to use that knowledge. Moreover, he must foresee immediate use. Only as the race grew older did man become provident against the rainy day and acquire for the sake of possible contingencies. Only as the child approaches manhood's estate does he begin to take pleasure in acquiring for more remote use. It might be added here incidentally that the race never acquires or learns without seeing the utility of so doing. Only pedantic school-masters argue for acquiring knowledge for knowledge's sake, or for an abstract discipline. These deeply implanted race instincts should be respected. Ideally we should never require a child to learn an atom of knowledge unless it can be made to appeal to him as worth while. Otherwise we are proceeding entirely counter to a most fundamental law of nature.

Order of Motor and Mental Activities.—The relative order of the development of manual and mental activities corroborates in a striking way the law of recapitulation. The race was for a vast length of time engaged in manual labor. In fact, the great majority of mankind still toil with the hands. The life interests of humanity demand these activities. Success as a result of headwork in an office or in the invention of machinery is of recent origin. Anthropology and history show that primitive man enjoyed bodily activity—not necessarily the drudgery of work, but the chase, warfare, and bodily contests. Mankind in general would prefer bodily activity to mental if it only paid as well.

In the child we see the racial order retraced. What normal child prefers a stuffy school-room and books to work on the farm with tools, or the most menial kinds of manual service? Children's spontaneous plays (which are their work) are always chosen from among manual activities. My children saw, plane,

fashion all sorts of implements, vehicles, circuses and shows; sew, make doll clothes, etc.; but they plan little intellectual work which does not have manual activity as a basis. Ask children under ten what they would like to be and they almost invariably answer, a drayman, a carpenter, a farmer, a wood-sawyer, a bricklayer, a paper-carrier, a dressmaker, a cook, a gardener, etc. Even children of professional men choose such vocations. The occupations in their environment have made little impression upon them, and that of a negative sort.

When shall we learn that the child is right in these things? Give a child a few tools, an opportunity to work in the garden (with you, of course), allow him to split and pile wood, wash dishes, cook, dust the floors, mow the lawn, or help on the farm, and you find a responsive chord at once. Properly directed, given under conditions not to make it repugnant, and allowed to be apparently spontaneous, manual work will appeal to any healthy boy or girl. Even in the high schools and colleges, students have not ceased to prefer manual activities to mental. Compare their enthusiasm over foot-ball with that for mathematics! And the foot-ball is not play either. No body of students is quite so enthusiastic over prescribed tasks as are engineering students. Without doubt, much of their enthusiasm is created through the element of manual work which always leads to the making of something. A better recognition of the place of the manual arts and crafts in all grades of school work is much needed. To afford them a proper place in the lower grades, especially, is imperative. Unfortunately we study how to keep children out of the very things they are just spoiling to do.

Spencer's Views on Recapitulation and Education.—Spencer was thoroughly committed to the idea that "the education of the child must accord both in mode and arrangement with the education of mankind as considered historically; or in other words, the genesis of knowledge in the individual must follow the same course as the genesis of knowledge in the race." Again, he wrote that "education should be a repetition of civilization in little. It is alike probable that the historical sequence was,

in its main outlines, a necessary one; and that the causes which determined it apply to the child as to the race."[1]

Sense Awakening before Reflection.—In the child, as in the race, the senses are alert long before the higher powers of association have developed to any extent. For long ages the race lived a life filled with simple sensory-motor reactions. Hunger was felt and means were employed to satisfy it. This done, effort ceased. The demands of the morrow were not considered until that time came. Inventions were not wrought out. The forces of nature were observed, but few means of utilizing them were devised. From lack of relational insight such as was necessary to connect the expansive force of steam and the action of a lever, the secrets of nature were long unguessed. It was only after long ages of activity in the simpler processes of relating sensory impressions and concrete ideas which developed association fibres and tracts, that the abstruse problems of invention, discovery, and scientific thinking were made possible. Similarly in the child we find at birth that the nervous mechanisms necessary for carrying on abstract thought processes are entirely wanting. From lack of structural maturity the child is even blind and deaf for some days. But although the functions of sight, hearing, and all the other senses advance with great rapidity, the processes of rational thinking develop very tardily. Structurally we find that the higher brain areas, such as the frontal lobes and the association fibres, are relatively undeveloped. The frontal lobe must grow and the association fibres must connect the various areas before any high degree of relational thinking can be carried on.

Apropos of the foregoing, Hinsdale may be quoted:[2] "In his first years the Colossal Man, far from being a metaphysician, or even a natural philosopher, lived in his senses. His first course of study, so to speak, was furnished by his external surroundings. It was nature-stuff. Physics was before metaphysics. The same is true of every individual who joins the great procession that we call the race."

[1] *Education*, p. 122. [2] *Second Yearbook, National Herbart Society*, p. 120.

The Lengthened Period of Human Infancy.—We have noted that the protozoans are very simple, undifferentiated structures and that their psychic life consists of a few simple acts directed toward food-getting. It remains to be further observed that they continue practically unchanged from the time they enter upon an independent existence, as a result of division of the parent cell, until they subdivide to form new independent daughter cells. They are the only animals with "all-round" development and with unchanging form and capacities. Even the animals with rudimentary nervous systems develop little physically or mentally during their round of existence. Their actions are practically all instinctive. As soon as born they can take care of themselves as well as they ever can. Practically all their actions are predetermined for them by the inherited tendencies of their organism. Such animals acquire practically nothing through individual experience. Heredity is practically everything for them. In these lower orders there is no period of infancy, in fact there is no necessity for it, nor possibility. Each individual does just what its ancestors have done, in a reflex, automatic way, and we have seen that its nervous system is adapted to that mode of existence. The actions are so few and so simple that the tendency becomes perfectly ingrained in the nervous system before birth.

As soon as any form of life finds it necessary to adapt itself frequently to new and unusual conditions in order to maintain an existence, individual progress becomes necessary. The accumulations of racial experience no longer suffice to adjust it to environing conditions. It becomes necessary for the individual to be able to continue developing after birth. The nervous system, formerly developed only so as to preserve inheritance as reflexes, then adds other centres which control individual adaptations. This was at first very slow, so that even animals like birds depend largely upon inherited reactions. Their lives are exceedingly simple as compared with that of the administrator of a great industrial, political, or social organization, who must grasp and evaluate a multitude of complex relations. In this

higher stage it is impossible in the short period before birth to effect the organization of such complex reactions. John Fiske, who was the first to point out the significance of the period of infancy in the evolution of educable beings, wrote: "Instead of the power of doing all the things which its parents did, it starts with the power of doing only some few of them; for the rest it has only latent capacities which need to be brought out by its individual experience after birth. In other words, it begins its separate life not as a matured creature, but as an infant which needs for a time to be watched and helped." [1]

In the ascending scale of life we observed a gradually increasing complexity of physical structure, especially as evidenced in the sense organs and the nervous system; a gradual evolution of an increasingly complex psychical life; and now we remark another correlation, that of a gradually lengthened period of infancy. The chick, though dependent for protection for some time, has most of its life reactions fairly well organized at birth. Puppies, kittens, and whelps are much more helpless for several weeks or months, though they do not learn much as individuals. Anthropoid apes are the most helpless at birth of all non-human beings, as well as the most educable. For a month the young orang cannot stand alone. It begins much like a human infant by holding on to various objects for support. Fiske says [2] that the "man-like apes of Africa and the Indian Archipelago have advanced far beyond the mammalian world in general. Along with a cerebral surface and an accompanying intelligence, far greater than that of other mammals, these tailless apes begin life as helpless babies, and are unable to walk, to feed themselves, or to grasp objects with precision until they are two or three months old." At a corresponding age monkeys have mastered the operations of locomotion and prehension.

The period of human infancy is so greatly prolonged that the human child is the object of tenderest solicitation and care for many years. Even with all the care they receive, about one-third of the human race die under the age of five years. Properly the

[1] *Destiny of Man*, p. 40. [2] *Destiny of Man*, p. 53.

period of human infancy extends to the age of twelve or thirteen years, the age when it is possible (though highly undesirable) for them to maintain themselves, if absolutely compelled to. If it is held to include the entire age of plasticity and teachableness, as has been done by some (Butler, Fiske), it would comprise the period of adolescence as well. This would not be an erroneous mode of conceiving it.

Fiske writes:[1] "Infancy, psychologically considered, is the period during which the nerve-connections and correlative ideal associations necessary for self-maintenance are becoming permanently established. Now, this period, which only begins to exist when the intelligence is considerably complex, becomes longer and longer as the intelligence increases in complexity. In the human race it is much longer than in any other race of mammals, and it is much longer in the civilized man than in the savage. Indeed among the educated classes of civilized society, its average duration may be said to be rather more than a quarter of a century, since during all this time those who are to live by brain-work are simply acquiring the capacity to do so, and are usually supported upon the products of parental labor." Dr. Butler says on the same point that, "as our civilization has become more complex, as its products have become more numerous, richer, deeper, and more far-reaching, the longer we have extended that period of tutelage, until now, while the physiological period of adolescence is reached in perhaps fourteen or fifteen years, the educational period of dependence is almost twice as long. That is to say, the length of time that it takes for the human child in this generation so to adapt himself to his surroundings as to be able to succeed in them, to conquer them, and to make them his own, is almost, if not quite thirty years. The education in the kindergarten, the elementary school, the secondary school, the college, the professional school, the period of apprenticeship in the profession before independent practice can be entered upon, is in not a few cases, now twenty-five, twenty-six, twenty-eight or even thirty years."[2]

[1] *Cosmic Philosophy*, II, p. 342. [2] *The Meaning of Education*, p. 12.

Adolescence in this view is simply a special and marked period of infancy. Considered either way, infancy is a significant phase in the development of an individual. It was also a great stride in evolution toward the development of psychical domination in the world as opposed to brute force.

Thus the period of dependence, in a sense the period of infancy, is not only very long in the human being as compared with all other animals, but it is increasing as civilization increases in complexity. To live under conditions of modern civilization and become properly adjusted to them requires such a vast number and variety of adaptations that one can become properly prepared for it only after a very long period of many-sided education. One may very properly question whether the demands of the present are not rendering the complexities so numerous and intricate that the effort toward adjustment is at the expense of proper balance between physical and mental possessions. Is it not drawing upon nervous energy at the expense of bodily? Has evolution proceeded far enough to admit of such extreme psychical specialization? Or have sufficient organs in the way of machines and contrivances been evolved to sustain the functions which modern life has imposed? To have an intimate and comprehensive knowledge of one's business or vocation, each a thousand times more gigantic and intricate than a century ago; to keep up with the day's doings in the world; to disentangle the myriad political, commercial, and social relations of all the nations; to assimilate the world's past and to interpret its present; and to evolve out of all this a philosophy of life; (and nothing mentioned can be omitted by the one who keeps up with the times)—to accomplish all this imposes a drain upon nervous and mental force unexampled in all the history of evolution.

Fiske has made the striking point that the development of society was directly dependent upon the initiation and prolongation of a period of infancy. All political and social institutions are mainly an outgrowth of the family. The institution of the family was made necessary and possible through the helpless-

ness of offspring. Their helplessness aroused mutual feelings of sympathy in parents and older offspring, resulting in longer periods of close companionship. Finally not only family interests and bonds were developed, but also community relationships. An examination of the genesis and growth of morality reveals also that morality is concomitant with the growth of community life. Incipient morality is first observed in the social animals, and it develops progressively through the lowest human tribal organization up to the highest altruistic communities. Here are two important directions in the highest education of man accomplished through the period of long infancy. Current history as well as evolution chronicles the same lesson. Discords, divorces, and separations are astonishingly more frequent in households where no children have cemented the bonds that first produced the union. Childless people are usually devoid of many feelings of sympathy that actuate persons who have children. This is especially true where the parents were "only" children and reared in affluence. Thus since the state and all higher forms of institutional life rest upon the family, the child should become the centre of regard in our noblest efforts to uplift humanity. Through all his years of plasticity the wisest nurture should be afforded that will assist nature in unfolding what is best in the child and extend his evolution to the highest point possible.

Besides the best physical and physiological inheritance to which the child is entitled and which the best of nutrition and care should develop undiminished, there is a social inheritance which is the birthright of every human individual. This social inheritance is bequeathed to posterity not in the form of fixed structures and reactions, but in the works of man as represented in institutions, discoveries, arts, sciences, traditions, and beliefs. Butler says these spiritual possessions "may be variously classified, but they certainly are at least five-fold. The child is entitled to his scientific inheritance, to his literary inheritance, to his æsthetic inheritance, to his institutional inheritance, and to his religious inheritance. Without them he cannot become a

truly educated or a cultivated man."[1] He further maintains that, "The period of infancy is to be used by civilized men for adaptation along these five lines, in order to introduce the child to his intellectual and spiritual inheritance, just as the shorter period of infancy in the lower animals is used to develop, to adjust, and to co-ordinate those physical actions which constitute the higher instincts, and which require the larger, the more deeply furrowed, and the more complex brain. That, as it seems to me, is the lesson of biology, of physiology, and of psychology, on the basis of the theory of evolution, regarding the meaning and the place of education in modern life." [2]

Recapitulation and the Relative Value of Knowledge.—In seeking an answer to the question, "What knowledge is of most worth?" Spencer turned to race history. He assumed that knowledge to be most fundamental which was first developed by the race and therefore of most worth at all times. This elemental knowledge he finds to be that which directly ministers to self-preservation. "That next after direct self-preservation comes the indirect self-preservation which consists in acquiring the means of living, none will question." Third in order come "those activities which have for their end the rearing and discipline of offspring. . . . That a man's industrial functions must be considered before his parental ones, is manifest from the fact that, speaking generally, the discharge of the parental functions is made possible only by the previous discharge of the industrial ones." Next in order he places "Those activities which are involved in the maintenance of proper social and political relations." This he regards as following the phylogenetic order, "As the family comes before the State in order of time—as the bringing up of children is possible before the State exists, or when it has ceased to be, whereas the State is rendered possible only by the bringing up of children; it follows that the duties of the parent demand closer attention than those of the citizen." The final group of race activities which determine the relative values of instruction for the individual are "Those

[1] *The Meaning of Education*, p. 19. [2] *Ibid.*, p. 31.

miscellaneous activities which make up the leisure part of life, devoted to the gratification of the tastes and feelings." [1]

The foregoing furnishes a fairly good order of emphasis of different kinds of knowledge. Of course, each is intricately interwoven with all the others, but the order suggested is practically coincident with the order of the development of the individual's interests in the various activities. That the types of knowledge taught in the schools should harmonize with the natural rise of interests is sound doctrine. At every stage the school should be correlated with life's dominant, legitimate interests.

Many more educational applications suggested by embryology will be stated in the chapters on "From Fundamental to Accessory," "Instinct," "Correlations between Mind and Body," "Sensory Education," and "Motor Education." The next chapter deals with a special phase of application in the "Culture Epochs Theory."

[1] Spencer, *Education*, pp. 32, 33.

CHAPTER VI

THE CULTURE EPOCHS THEORY AND EDUCATION

Meaning of Culture Epochs.—Various attempts have been made to map out the periods of child development and to study them in the light of corresponding periods of racial development. Exponents of the "Culture Epochs Theory" assume that the particular kinds of environment, experience, or education which the race received and which produced particular development in the race at certain periods should produce the same sort of development in the individual at corresponding periods. It is also assumed that the child must retrace each of the phylogenetic stages in order to develop normally. Hence a study of the race has been made to determine what kind of culture materials contributed to its progress from each given stage to the next higher. This is done n order to give the child the same sort of material at a corresponding period. During a certain epoch it is known that man was evolving myths, legends, and folk-tales. These are believed to have been the culture materials which enabled the race to develop into a higher stage. Different interests and activities occupied the dominant place at different periods. At one period it was war, at another the hunt and chase, at another the beginnings of agriculture, etc. The mental life as manifested in speech, song, poetry, and literature also corresponded to dominant interests. Thus different culture materials are supposed to have been utilized at different epochs of race history. Hence the term "Culture-epochs." It is thus seen that we may speak of the pastoral epoch, the nomadic period, the stone age, the bronze age, the hunting stage, the agricultural epoch, the urban period, etc.

Herbartian Applications.—The Herbartian school of educationists especially have attached much value to the culture epochs theory of education. They have arranged very definite pro-

gram of study which they believe to be fitted to afford the child the specific culture necessary to assist him wisely into the next stage of growth. The following outline scheme represents the ideas of Professor Rein, of Jena, as to the proper sequence and arrangement of materials for the German Volks-school.[1]

SCHOOL YEAR	MATERIALS OF INSTRUCTION		GENERAL CHARACTER OF EPOCHS
1	Folklore and Fairy Tales		Mythical and Heroic Mind
2	Robinson Crusoe		
3	*Sacred*	*Profane*	
	Patriarchs and Moses	Thuringian Tales	
4	Judges and Kings	Nibelungen Tales	
5	Life of Christ	Christianizing and Kaiser Period	Mediæval State building
6	Life of Christ	Kaiser Period	Historic Mind
7	Paul	Reformation	Social and Political Development. Scientific and Philosophic Mind
8	Luther	Nationalization	

Dr. Otto Beyer has set forth,[2] as shown below, the chief stages of human development, when viewed from the side of man's reaction to his varying environment. The instructional material which would be desirable for the child representing each epoch is also indicated.

SCHOOL DIVISIONS	RACIAL EPOCHS	CULTURE MATERIAL
1	The Stage of the Hunter	Robinson Crusoe
2	The Nomadic Stage	History of the Patriarchs
3	Agricultural Epoch	History of the Kings and Judges
4	Epochs of Primal Division of Labor, Development of Manual Trades, Retail Trade, and Small Cities	German Middle Ages
5	Metropolitan Life, Wholesale Trade, Great Industries	Modern History of Germany

[1] Van Liew, *First Yearbook of the National Herbart Society*, p. 99. [2] *Ib.*, p. 97.

Professor Ziller, in his practice school at the University of Leipsic, used the following materials and arrangement as the centre of instruction in each of the eight years of the Volksschool: 1st year, *The Epic; Folklore Stories from Grimm;* 2nd year, *Robinsoe Crusoe;* 3rd year, *History of the Patriarchs; Heroic Age of Germany and Thuringian Nibelungen Myths;* 4th year, *Heroic Times of the Hebrews; Moses and the Judges; History of the German Kings;* 5th year, *David and the Kings of Israel; History of Germany from Barbarism to Rudolph von Hapsburg;* 6th year, *Jesus and the Prophets; History of the Reformation and Frederick the Great;* 7th year, *History of the Apostles; Secular History of Antiquity;* 8th year, *Final Review of the Catechism; The Reformation.*

Professor Van Liew writes [1] that: "Beginning with the third year a second series of material drawn from profane history (that of the fatherland) is co-ordinated with the sacred series. In these thought-wholes of material the pupil traverses, corresponding to his own development, the chief periods in the development of mankind." Ziller wrote: "All history, and in fact the entire cultural development both of a single people and of all mankind, is stored up chiefly in the masterpieces of language; and the chief epochs of this development quite accord with the chief stages in the individual development of the pupil. Hence the mental development of the pupil cannot be furthered better than by drawing his mental nourishment from the universal products of culture as depicted in literature."

Miss Harriet Scott, in *Organic Education*, outlines a minutely detailed plan of work designed to suit the varying stages of growth recapitulated by the child. In the first grades (five to six years), *Hiawatha* is to be the core around which all instruction and activities are to be grouped. *Hiawatha* is chosen because,[2] "The child at this age is yet in the dawning of his mental life. The dominant interest of this period of development may be characterized as sense-hunger. His interest is a veritable hunger which, to satisfy itself, seizes upon every fact

[1] *First Yearbook of the National Herbart Society*, p. 85.
[2] *Organic Education*, p. 68.

of the natural and institutional world that comes within range of his senses.

"In brief, he begins at this epoch to organize his knowledge. . . . This is the period of his strongest affection for all things in nature. There is now no barrier between him and them. He is in a real sense one with them. . . . He contrives rude means to his own ends, just as Hiawatha devised his own implements of warfare or industry and the necessary means of communication and of transportation. . . . In this grade the nomadic period of civilization is covered, Hiawatha, the Indian boy, being the type of the period. . . . The child is encouraged to compare himself with Hiawatha in respect to self-reliance, ability to contrive, accuracy of observation, etc., until the ideal has taken firm root in his mind and is used as a standard unconsciously."

In the second half of the first year the children take Kablu, the Aryan Boy, as their chief pabulum. "For the child of this grade, the Hiawatha period of intense curiosity, imaginativeness, and contrivance has merged into the period represented by Kablu, a stage of curiosity somewhat less acute, of imagination somewhat less dominant, and of contrivance more complex and finished. . . . Kablu, the little Aryan boy, represents the agricultural period of civilization."

Darius, the Persian boy, forms the centre and circumference of all the boy's thoughts during the next half-year. Cleon, the Greek boy, is brought on the scene for grade B2; while Horatius, the Roman boy, is reserved for A2. The next half-year seems to be epitomizing history with gigantic strides and Wulf, the Saxon boy, is put on the scene to inspire the child in B3. Gilbert, the French boy, Columbus, Raleigh, the Puritans, all pass in review, and by grade A4, or at about ten or eleven years of age, the period of national development is reached. The rest of life seems to be a process of becoming adjusted to the present, since no new periods of study are suggested.

Miss Scott has designed to arrange the culture materials so that they minister to the dominant instincts. "Every period

studied may be said to branch into three great trunks—nature, institutions, and art." While it is a sound pedagogical procedure for general guidance, it is erroneous to suppose that the minute correspondence between phylogeny and ontogeny can be discerned. It is still more chimerical to assume that the exact racial culture means need be or can be utilized in trying to aid the struggling individual to pass through the various stages of metamorphosis. New means must be devised to meet new conditions of life and development. This is the great law of life and progress.

Critical Considerations.—Educationally the law of recapitulation has wonderful significance, especially in relation to instinct, but it is important to understand it thoroughly before attempting to construct details of school curricula in accordance with its teachings. The theory of recapitulation shows that the law of the conservation of energy is operative in mental as well as in physical evolution. Race energy and power are conserved in the individuals comprising the race. All of past racial history is written in each individual, but it must not be supposed that the writing is easily legible. It is an exceedingly intricate system of hieroglyphics, which the various sciences have only just begun to spell out. It must not be expected that each experience of all the myriads of individuals of past generations can be traced out in their original identity. It must not be thought that all the identities have been retained.

As will be shown in the chapter on memory, no experiences are ever lost, but they may lose their identity. I am the heir of all the ages, but I am not permitted to count my inheritance in the same denominations as did my ancestors. It has gone through many courses of exchange. Or, to change the figure, each individual is a resultant of all the forces brought to bear upon his ancestry and himself. To compute or discover each factor would be impossible to a finite being. Facts and logic compel us to believe that each individual epitomizes race history, *i. e.*, ontogeny recapitulates phylogeny. But it must be kept in mind that each individual is a resultant of forces many of

which have operated against each other, and consequently may have had counterbalancing effects. Biologically this would mean elimination or annihilation of various potencies acquired through experience. Biology has suggested the theory of recapitulation, but it should be understood that the most careful study of embryology fails to reveal more than the outlines of the course of development. As Balfour has written:[1] "Like the scholar with his manuscript, the embryologist has by a process of careful and critical examination to determine where the gaps are present, to detect the later insertions, and to place in order what has been misplaced."

Recapitulation Insufficient to Determine Course of Study.—It is plain, then, that the doctrine of recapitulation alone is not a safe guide in determining the detailed materials of instruction or its exact sequence. That the race was occupied at a particular period with certain ideas or activities is no reason for giving the child the same ideas and activities. The development of the child must determine these matters. We have seen that the correspondence between race and individual development is in no way exact; it is merely a general resemblance. The child of to-day resembles *the young* (not the adults) of more immature races, but passes beyond them in his ultimate development.

Phylogeny and Individual Interests.—The interest which children exhibit in fairy tales and myths is said to arise at that particular period because they are retracing the corresponding period of racial history. It is claimed that they are more interested in these and can comprehend them better than products of our own civilization. For similar reasons history is taken up in a chronological order, it being assumed that the child is interested in ancient history first, and only lastly in modern phases. It is even claimed that the study of science should follow the order of its discovery. It is true that instinctive potentialities determine the general type of interest, but it is not true that the child can comprehend most easily that which

[1] Quoted by Baldwin, *Mental Development*, p. 28.

is most ancient. The very opposite, indeed, is apt to be true. That which is remote is so far removed from the realm of his experiences that it finds no point of contact in the child's thinking. Ancient history cannot be comprehended by the child until he gets some background of present-day experience through which to view the past. That which was wrought out by primitive peoples may be the most difficult for the child to understand. I well remember my own attitude of disgust with the mythical history of Greece. It was only after understanding something of the psychological development of myths that I became interested in reading such history. On the other hand, the stories of the Civil War, in which my father and other relatives had taken a part, were always listened to with the most intense interest, while Jason, Hannibal, Pyrrhus, and all the rest of those whose manners were so strange, were avoided except as tasks. As a student of the philosophy of history, I have been interested in the evolution of the enginery of war and political units, but as facts they never interested me when a child. The child wants concrete experiences that he can respond to and not philosophy.

I have asked kindergartners why they had birch-bark canoes, wigwams, and primitive ploughs for the children to study and not something more modern. They replied: "The child could not understand modern complex things, and he would not be interested in them. He must have more primitive products." I have no objections to the wigwams and the savage trinkets, but I have to the principles stated. A given object or activity may be ever so "modern" and still be the delight of children, provided it comes within their comprehension. A sixteen-shot Winchester rifle is no more puzzling to a boy of ten than would be a cross-bow of savage tribes. A modern gang-plough, a steam engine, or an automobile is as simple to the child as the rudest modern implements or those of the ancient Egyptians; the modern telephone and the postal system are quite as comprehensible to a modern boy as the means of communication in vogue ten thousand years ago; in fact, they are simpler to him,

because they deal with things of observation and experience. To be sure, the boy does not comprehend the philosophy of all these modern processes—what he sees are externals. These he takes as matters of course and extracts no complexities. The child sees things superficially, in broad outlines only, and complex surroundings produced by telephones, telegraphs, trolley-cars, and newspapers present no greater complexities to the modern child than abiding in a wigwam and living by hunting. Children may be in homes where philosophy is discussed, but they hear it not. Complexities of life exist all about the child, but he responds only to that for which his development has attuned him. Later on he becomes fitted by complexity of neurological and psychological development to vibrate in harmony with a more complex order of things—but not necessarily those things only which have come within ancestral experience.

Imitation and Interest.—I well remember, when a child, trying to fashion modern mowing-machines and threshing-machines. I did not take to scythe-making, or threshing with a flail, or even tramping the grain out with the feet. The fact is, that children imitate the life about them as they see it. The things that interest them are the things re-enacted. It may be foot-ball, or marching to the sound of martial music, but in either case they will have none but the most modern paraphernalia. Nothing but sweaters and padded knees, swords, guns, and drums will answer.

When we foist upon the child the products of civilization in the order in which they were developed and because they were so developed, we are trying to make him realize an adult philosophy of development. Prof. Simon N. Patten[1] "points out that the argument often advanced in behalf of the culture epochs, that modern life is too complex for the child to grasp, and that education therefore must begin with ancient materials to get initial simplicity, is weak." He asserts that "the sickle is not simpler to the boy than the harvester, so long as both repre-

[1] Pub. Am. Academy Political and Social Science, No. 136.

sent to his mind the process of reaping. The same would be equally true of the most complex piece of social, industrial, or political mechanism, as long as the child can see what it accomplishes. The argument holds good, however, only so long as we contemplate the mechanism merely in the performance of its function; let it once become the object of analytic investigation of structure or of development and the case is reversed. Then the sickle is simpler than the harvester, and it is by such analysis that the object is understood by us."

It has been asserted that children will reproduce the activities suggested in mythology, Robinson Crusoe stories, etc., rather than the various activities which they witness about them daily. My own observations lead me to the opposite view. Many other persons with whom I have talked, confirm my views. My children build not palaces of the giant, nor the home of Cinderella, but instead they construct bridges, railway trains, fences, barns, houses of modern pattern, automobiles, etc. The factors determining the children's specific activities are interest and imitation, not ancestral experience. Ancestral experience may and does place limitations upon powers and capacities of the individual, but the order of racial experience is absolutely unreliable as a guide in determining the order of the details of individual instruction. The individual is not a *sum* of all racial experience, but rather a *resultant* of all of them in which the particular experiences have largely lost their identity.

Conclusions.—Although the knowledge of recapitulation and the culture epochs does not furnish a guide-book for the details of educational practice, yet it is of the utmost significance in marking out the broad outlines of educational procedure. Even though it were not true that ontogeny recapitulates phylogeny, there is such a close *correspondence* or *parallelism* between the development of the individual and the ascending forms of life that each can throw much light upon the other. The failure of the culture epochs to furnish a curriculum is not due to any unreliability of the law of recapitulation. The main reasons why a knowledge of the kind of culture materials

utilized by the race at a given time cannot furnish this guidance are twofold, viz.: first, a given kind of stimuli may produce very different reactions upon different individuals. The effect depends upon all previous effects. The child of to-day is not just like the man of yesterday. The child of to-day is like the child of yesterday, plus the potentialities of the man of to-day. Second, since so many short-circuits have been established, the details of successive stages have become so obscured that only large outlines are observable.

A knowledge of phylogeny has been of great value in assisting us to understand the order of development of the latent powers. Knowing the phylogenetic order of unfoldment will assist in securing appropriate stimuli for the awakening of the various powers. Many diverse kinds of objective stimuli might be employed, however, to secure a given general type of reaction. The particular kind of stimuli most efficient will depend largely upon the individual's interest, that in turn being dependent upon environment. Thus the culture epochs theory is more suggestive as to the method of approach than as to the content of the curriculum. It is doubtless also very suggestive as to the order of presentation of the different aspects of a given subject. The very same material may be presented in concrete details or as scientific abstractions.

The culture epochs theory shows plainly that the order should be from simple to complex, from the concrete to the abstract, from sensory impressions to abstract relations, etc. But the materials employed by primitive man may be considered in scientific relations, or present-day knowledge may be considered in a very simple way. The scientific truths about steam discovered by present-day man will ever be scientific truths and unsuitable for children. Similarly the obvious concrete phenomena regarding steam will ever be concrete. Their availability for cultural material in the education of children will in no wise depend upon the time of their discovery by man, but upon the interest determined by their relation to life activities. In conclusion, a knowledge of the order of the unfolding of the

various powers is important, the particular material utilized in furthering this development is relatively less important. The discussion of instinct, heredity, and the law of from fundamental to accessory, shows more clearly how inherited impulses and tendencies may be utilized in education.[1]

[1] For a more extended critical discussion of the culture epochs theory by the author see *Journal of Pedagogy*, 16 : 136–152.

CHAPTER VII

FROM FUNDAMENTAL TO ACCESSORY IN EDUCATION

Meaning.—In studying children and lower animals it has been noticed that at birth certain movements and certain parts of the body are much better controlled than others. The child can move its whole body with much force; the legs and arms also can be moved with great strength, while the fingers seem powerless and entirely lacking in precision. A little reflection further recalls the fact that the vital processes of respiration, digestion, and circulation are thoroughly functional at birth, while processes of thinking, speech, writing, and walking have to be learned through toilsome endeavor and after some degree of maturity is reached.

From the stand-point of structure we find that those organs which are the most vital, the oldest, and most stable are the first to be developed. The heart, lungs, circulatory organs, and skin are developed before the special organs of sense. An individual could exist without eyes or ears, but not without organs of circulation. In the growth of the bones those which form the framework are first developed. The backbone, the large bones of the trunk and the head, develop first, and later those of the limbs. The larger bones precede the smaller ones, such bones as the fingers and toes appearing late in fœtal life. The teeth and the finer bony structures of the ear are of late appearance; the former, though rudimentary in late fœtal life, not becoming visible until months after birth. The muscles follow similar lines of growth and development. The great muscles of the trunk and limbs judged from both the stand-point of function and structure are developed before the muscles of

the hand, the face, and the eye. A child can move its entire body vigorously, roll over alone at a few days of age, kick vigorously and throw its arms about, but it is a long time before it can pick up a pin from the floor, hold a pencil steadily enough to write, or control the movements of the eyes. The eyes are so unco-ordinated for weeks and even months that one can scarcely tell in which direction many children are looking. Of course, there are many individual differences, but the order of development is the same for all.

Those movements and structures which appear earliest and which seem so important to simple existence are termed fundamental. Those which develop later, and which seem necessary only to complex existence, are termed accessory. The order of development from those simpler modes and types to the more complex is termed "from fundamental to accessory." The terms fundamental and accessory are not employed here as referring to any fixed sets of organs or functions. The meaning is relative instead. In a general way, by fundamental we mean also that which is vital and necessarv to existence. By accessory we mean that which is less vital and in a way less necessary to existence. The entire expression "from fundamental to accessory" means that development proceeds from that which is relatively simple, fixed, stable, and indispensable to that which is less so. Usually that which is the more fundamental is earlier developed than the accessory.

Order in Phylogenesis as in Ontogenesis.—This order of development from fundamental to accessory is true not only of the growth of individuals but also of the race. All animal life has doubtless evolved from very simple types. The earliest, lowliest, most primitive organisms possessed only the structures and functions absolutely necessary to existence. A single organ, the skin, as shown before, served many purposes equally well. Refined sensory organs, prehensile and motor organs, were of very late acquisition. While convenient, wonderfully useful, and marks of the highest aristocracy in animal development, most of the late acquisitions could be dispensed with and life

processes still continue. Considered comparatively we observe that the lower animals perform all the vital functions as well as or often better than human beings. The latter have degenerated in this direction in many cases through the processes of higher specialization. All of the higher animals begin life as unicellular germs and gradually become differentiated by the development of specialized and more complex structures.

Illustrated in Development of Nervous System.—In the development of the nervous system we find an excellent illustration of the law under discussion. The first portion to develop is the spinal cord, which in the individual and the race is at first a simple affair—mainly a comparatively straight undifferentiated tube. Following this the various collateral branches forming the peripheral system with the end organs of sense develop. There occurs along with this differentiation the specialization of one portion of the nervous system into the brain. The brain itself develops gradually, and so-called different "levels" develop at different times. The medulla develops first, the cerebellum next, and last the cerebral lobes. Even here the complete development does not occur all at once. The frontal areas and other most highly specialized areas are the very last to develop to functional maturity. It is not to be inferred, of course, that each stage or level is completed before the next begins. The development of many parts goes on synchronously and there are only slight differences between a given level and the next higher. But when we compare a very low, vital, and fundamental portion with a very high and late function, the difference becomes striking. For example, all vital or vegetative functions are controlled by the spinal cord, which is the seat of control of reflexes. This becomes functional very early, while the frontal cerebral lobes are very late in morphological and functional development. The spinal cord is so fundamental and absolutely necessary to life that the slightest injury to it causes death. On the other hand, the cerebral lobes may be burned, electrified, or even excised and life goes on—sometimes apparently unaffected by the injury.

Professor Tyler[1] has the following to say: "What we call our brain has been builded by successive additions at very different periods of geological history. Medulla, cerebellum, mid-brain, and the basal ganglia of the cerebrum are old. They may all date from early palæozoic time. The cortex is far younger, and its portions are of different ages. The association areas very probably did not arise until well on in tertiary or cenozoic time. They are still far from their final and complete stage. Our brain is much like the fortress-palaces so common and striking in certain parts of France. Their foundations are old, heavy, and strong; capable of resisting anything except modern artillery. The successive additions grow steadily lighter, more complex, more graceful, and better fitted for a higher civilization. So the old fundamental centres are the fortress foundations of the brain, the seats of endurance and resistance. If they are neglected or incompletely developed, the whole brain structure totters or collapses. They, far more than the higher centres, claim and require our attention throughout childhood. In late childhood or adolescence we can develop the finer powers. We see clearly that mental exercise of a logical sort has added only the finishing touches to the development of the brain."

Dr. Ross[2] first called attention to the difference between the two types of structures. He wrote: "The portions of the nervous system which man possesses in common with lower animals and which are well developed in the human embryo of nine months, I shall call the *fundamental* part, and the portions which have been superadded in the course of evolution, which differentiate the nervous system of man from that of the highest of the lower animals, and which are either absent in the human embryo or exist only in an embryonic condition, I shall call the *accessory* part of the nervous system."

Order of Degeneration.—In the progress of diseases of the nervous system the order of degeneration is in the reverse direction; that is, from accessory to fundamental. The cerebral

[1] *Growth and Education*, p. 45.

[2] *Diseases of the Nervous System.*

lobes are attacked before the lower brain centres, and the brain before the spinal cord. In mental dissolution the same order is observable. The most recent acquisitions are the most fleeting. An old man forgets the new fact learned yesterday, but can recite details of early life by the hour. An old man of ninety years of my acquaintance continually forgot the recent events, acquaintances formed, work done, what he had read, etc., but could recite verbatim almost the whole of Webster's "Old Blue-backed Speller." He could detail his whole life history also up to sixty years. The later life was vague in memory. A knowledge of this order is of great importance in the medical treatment of nervous diseases. If the higher centres are diseased, the case is not nearly so serious as when the spinal cord is involved.

Some Pedagogical Blunders.—The pedagogic corollaries to be derived from the law of "from fundamental to accessory" are very important. In this law we have indicated the natural order of growth. To proceed counter to it in striving to stimulate and assist growth is to invite nature's sure and condign punishment. A lack of knowledge of the law has led to many grievous errors. In the near past, and unfortunately often in the present, the "three r's" have been regarded as the sole means of educational salvation for children, and at a tender age they have been sent to school and at once plunged into the intricacies of these processes. At that stage of life the finger muscles and eye muscles are relatively very immature and the fine adjustments and co-ordinations can only be accomplished through forcing. Even sitting so long, and, still worse, sitting still (often with hands folded, sometimes behind the back!), necessitates a tremendous nervous strain. The kindergarten with its ideals of freedom of movement in theory alleviates some of the ills, but even this beneficent institution has been guilty of great pedagogic sins. In the effort to standardize everything the play has become stereotyped and exacting, the motor exercises of stick-laying, weaving, pricking, etc., have required the manipulation of altogether too minute objects which the immature fingers and eye muscles are incapable of controlling, at least without enervat-

ing effects. Undoubtedly a whole crop of nervous disorders, eye strain, and debilitated systems has followed in the wake of pedagogic blundering. Many cases of St. Vitus dance, or chorea, have been directly traced to the premature use of undeveloped centres. Now the wise teacher, instead of requiring the child to follow a microscopic copy with a fine pen with which to do his first scribbling, lets him go to the blackboard and execute large unrestricted movements with the whole arm. In my childhood days the school-mistress punished us for drawing pictures, which were always done in bold outlines, but now the discriminating teacher encourages this as a means of securing muscular control.

Physical Growth Antecedent to Mental.—In race development and in normal individual development physical growth is always antecedent to mental. In race history man lived by brute force for ages before making use of his wits. In fact, for a long period he had little wit to exercise. Muscular strength was at a premium and its thorough development was a necessary preliminary to higher brain development. A corresponding order is observable in the unfolding of the individual. The child must be a good animal before he can become a good scholar. Unfortunately all this is unknown or forgotten by many in the education of the child. The legal age for compulsory school attendance is usually too low and the age of permissive attendance is a mark of the grossest educational blundering.

"If a function is exercised before the organs with which it is connected are prepared for use, by having attained to their development, demands are made upon them to which they are not prepared to respond. They are consequently overtaxed, and precocious exhaustion must be the inevitable result. The same result attends the too early use of any organ of the body. Take, for instance, the muscular system, which in a child is weak and delicate. If severe physical tasks be imposed upon the muscles, they not only break down but the whole organism of the child becomes disordered. Again, as regards the brain, which in early childhood is scarcely fit for any further use, so

far as the mind is concerned, than that of receiving impressions of surrounding objects, if it be spurred on to the making of what to it are strong efforts toward acquiring knowledge, it is not long before the evidences of serious derangement make their appearance, and an era of suffering begins, which becomes more and more strongly marked with every act of mental exertion which the child may make." [1]

The main business of the child should be to develop physically —to become a good animal. If he becomes a first-class animal with all the marks and attributes of health, strength, and vital capacity, he has a good foundation upon which to build a worthy mental—and shall we not say moral?—superstructure. To have at the dawn of adolescence big lungs, firm muscles, ruddy cheeks, and scintillating eyes is more important than to have the distinction of being first in one's class in the grammar school. To be able to excel in running, jumping, skating, wrestling, and base-ball is far more to be desired in the youth of fourteen than to excel in mathematics and Latin. Crudity of speech at that time is not a stigma, but to be halting in step, pale and anæmic, are sorry handicaps. Professor Tyler [2] says: "We do not ask the baby to solve problems in mathematics or philosophy. We expect and desire in him only the dawn of mind. We ask and pray that he will eat well, sleep well, wriggle and cry more or less, keep healthy, and grow. This is his whole duty. Bodily growth is his business. For how many years is growth the chief business of the child? Is it his chief business throughout the primary and intermediate grades? If so, what and how much is the school doing to promote growth during these years?" He further says: "A very wise and learned committee lays out for our schools a curriculum which does not assign a single period in the week to physical training, nor mention any such branch. They seem to have regarded the child as a disembodied spirit, or in great haste to become one. . . . In the grammar grade is learning and mental discipline of chief

[1] Surgeon-General, New York Post-Graduate Medical School.

[2] *Growth and Education*, pp. 20, 21, 45, 47, 58, 90.

importance to the girl, or is care of the body and physical exercise absolutely essential at this period? No one seems to know, and very few care. What would Nature say? If we disobey her laws, it will cost us a heavy penalty. 'The plowing of the wicked is sin;' not because plowing is not excellent, but because it is allowed to crowd out a far more important duty. Are some of our educational experiments and efforts sin? . . .

"Brain and muscle are never divorced in the action of healthy higher animals or of healthy man. They should not be divorced in the education of the child. God has joined them together; let not man by any artificial system put them asunder. . . . The child during its earlier years should be educated far more through its muscles and sense organs than directly through the brain. Hand and eye are now more efficient means of intellectual development than thought or even memory. The young child is largely an animal. The higher mental powers which characterize man do not appear until about the period of puberty. Our chief aim should be to keep him a healthy animal and to promote the growth of the fundamental organs and powers which alone can form a firm and stable support for all later additions and improvements. . . . Perhaps the child is hungry to run and we deem it better for him to sit still and try to think. We are attempting to exercise a centre in the brain which is in a stage of pure growth. The exercise does little or no good; it may do some or considerable harm. At the same time we are depriving the muscles of exercise which is absolutely essential to them. We neglect or fail to exercise the sensory and motor centres in the brain and wonder that the development of the higher centres is not more complete and harmonious. We forget that the finer muscles and the higher nervous centres require for their own development the highest possible efficiency and exercise of the fundamental parts. . . . Before eleven or twelve there are few really mental interests. The higher centres of the brain are not mature enough to crave much exercise. The child thinks; but must think as a child, not as a man."

Development of Voluntary Motor Ability.—Before birth and for months and even years after, the child executes a great many involuntary movements. His voluntary efforts are also sadly lacking in precision and ease. It is with difficulty that he learns to button his clothing, tie a knot, use scissors, manipulate the knife and fork, or use a pencil.[1] Idiots are notably lacking in precision of activities, frequently being unable to walk well, and still less to talk, use a pencil, tie a knot, or use a needle. The more fundamental the movement the better they execute it, and the more accessory the less the power of co-ordination.

Dr. Bryan[2] made a careful and extended series of observations upon the development of voluntary motor ability and gained some valuable data upon this question. He arranged a series of exercises in which children from six to sixteen tapped with the finger, using successively only the finger muscles, those of the wrist, elbow, and the shoulders. He ascertained that in both boys and girls the elbow and shoulder movements showed more maturity than those of the wrist and the finger. His results showed that at six the power of co-ordination of finger movements is decidedly less than at sixteen. The finger acquires ability in precision and rapidity largely after nine or ten years. In Dr. Bryan's words, "These results show that the shoulder grows most slowly and the elbow slightly faster, the wrist and finger very much more rapidly." Certainly this is very significant concerning the age at which to begin writing, piano-playing, and similar activities.

Close observation of children discloses to us that there is a frequent twitching of the peripheral muscles, such as those of the hand, the foot, the eye, various muscles of the face, and even the peripheral muscles of the skin. These twitchings continue during sleep. The eye, for example, is never absolutely still. In early infancy they are much more noticeable than at a later stage. They are perfectly normal phenomena and simply show

[1] This will be more fully discussed in the sections dealing with motor training and will development.

[2] "On the Development of Voluntary Motor Ability," *Am. Jour. of Psych.*, 5 : 125–204.

the immaturity and relative racial immaturity of these classes of muscles and of the centres controlling them. As the child grows older and the nervous mechanism becomes more perfected they gradually disappear from notice, although even in adult life the eye twitchings and other slight vibrations may be noticed by the careful observer. An interesting study of inhibition was made by Curtis, who found that the ordinary child cannot sit still more than thirty seconds, and children from five to ten years not more than one minute and one-half. What a cruel "breaking-in" he gets in the six hours of a school day! [1]

Professor Hancock conducted a series of experiments requiring children ranging from five to seven years to thread a needle, tie a string, hold the arm horizontally, suppress twitching movements, tap with the fingers, etc., and concluded that children can easily learn to make movements involving the large muscles, but that the finer co-ordinations come later. The order seems to be: body, shoulder, arm, forearm, hand. Control of the index finger is gained before the others.[2]

Some interesting and instructive observations and experiments have been made upon idiots. They are notably deficient in the finer co-ordinations. Dr. Ireland writes: [3] "The best and earliest sign of idiocy is the deficiency of grasp. The hand is flapped or vibrated about instead of being employed to seize or obtain an object. Imbeciles are clumsy in the use of the hands, *and it is difficult to teach them any exercise or handicraft requiring method and dexterity.* Even imbeciles . . . are generally very inexpert at such exercises as catching a ball, or aiming at anything, *and it is difficult to teach them greater dexterity.*"

Application to Training Feeble-Minded.—A knowledge of the order of development has completely revolutionized the methods of training idiots. Formerly it was thought that the way out of darkness led through the reading-book and the spelling-book,

[1] "Inhibition," *Ped. Sem.*, vol. VI, p. 93.

[2] "A Study of Motor Ability," *Ped. Sem.*, vol. III, pp. 9–29.

[3] *Blot on the Brain*, p. 64, 2d edition. (Italics mine.)

and so the first attempts were directed toward the formal school arts. The results were what we might expect. If not positively harmful, they were certainly the least desirable means of education. Now, instead of beginning with such accessory activities, teachers of the feeble-minded begin with the simplest possible bodily movements involving the largest and most fundamental muscles of the body. They are taught to walk, to run, to stand, to climb, throw, row, jump, and engage in plays and games. At first no exercises involving fine co-ordinations are required. Gradually more complex exercises are introduced. Only after vigorous bodily health, muscular tone, and a reasonable motor control have been secured are the traditional school arts introduced. Our schools for normal children have learned and may well learn valuable hints from a study of the feeble-minded.

Order in Psychic Development.—In the realm of higher and more formal mental education the same law will apply, although the exact order of appearance is not so well defined. It has long been understood that sense knowledge should precede more complex thought processes. The race lived a life of sense perception long before higher processes of elaborate thought were developed. Associations between sensory experiences and motor reactions in securing food, warding off enemies, providing shelter, furthering pleasures, and avoiding pains were sufficient for the needs of the time. Gradually more complex and far-sighted schemes were evolved and finer co-ordinations made necessary in shaping tools, producing pictures, and constructing more accurately the implements and articles used.

Similarly the child is contented with sensory experiences and immediate reactions upon his environment. Naturally his associations are of a relatively simple type. His reasonings are crude. Causes and effects are confused, as, for example, the boy of three said: "Let us hurry because the trees make the wind blow and it will be cold in the park." The child lives in the present. A single stick of candy to-day is more treasured than five promised to-morrow. At this period he learns things mechanically with ease, acquires isolated facts without noting

or establishing relations among them. Should this not caution us against the premature introduction of scientific relations, abstract formulæ, and abstractions of grammar? Facts of nature may be learned readily, but obscure scientific principles must be delayed. Grammar is ordinarily introduced too early in the curriculum, abstruse arithmetical deductions should give way in the first six years of school to the simplest facts and processes, and these should be so well drilled into the children's nervous systems as to make the operations automatic. These scientific facts, the data of biography and history, a knowledge of reading and writing, facts of geography and travel, ability to draw, to sing, to fashion various things in the manual arts, together with a strong body, supple muscles, big lungs, and a clean, healthy, unaffected mind should be the capital of a boy or a girl at the close of the grammar school course. Later schooling and life will give significance to these, establish new relations, evolve from them scientific laws and principles. They will also be the tools for acquiring and furnish an apperceptive background for future conquests of knowledge.[1]

Adaptation of Curriculum to Stages of Growth.—It is highly important that the educator be able to determine accurately the different periods in childhood and youth and clearly recognize their characters. Educational means must be adapted to the varying periods of development. One of the greatest pedagogical sins has been in the lack of adaptation of work to the needs of the varying periods of development. Abstract grammar and arithmetic have been placed in early childhood, but they are more fitted for university study. The child mind demands concrete instruction, that which appeals to sense perception and not to abstract reason. To invert the order is to sin against child nature. The period of the grammar school and the years preceding are periods of gathering rather than of organization; periods of sensory training rather than the development

[1] For a full and critical discussion of the entire topic, see Burk, "From Fundamental to Accessory in the Development of the Nervous System and of Movements," *Am. Jour. of Psych.*, vol. VI, pp. 5–64.

of reason. During this period, association fibres are forming in the brain and when they are fully established the reasoning processes may be cultivated, and not before.

Ross wrote apropos of this, that "until a few years ago the natural order of development was reversed in education, so far as this could be accomplished by human contrivance and ingenuity. . . . No sooner had what is technically called education begun than the professional trainer began to exercise the small muscles of vocalization and articulation, so as to acquire the art of reading; the small muscles of the hand, so as to acquire the art of writing; and, in the case of young ladies, the still more complicated movements necessary in running over the keyboard of the piano; while little attention was paid to the development of the larger muscles of the trunk and lower extremities, upon the full development of which the future comfort of the individual depends."

Illustration in Speech Development.—Hartwell[1] urged the importance of noting that in speech development there are at least three levels of growth. "The organs of respiration are the most central or fundamental of the series. The organs of phonation, which give vocal character to the stream of expired air from the lungs, are intermediate, and their neural mechanisms are, therefore, to be considered as accessory in comparison with those of the breathing organs, but relatively fundamental in comparison with the centres which represent the movements of the more peripheral organs of articulation. It is indisputably certain that the young child learns to breathe and cry aloud before it can speak, and that there is a progressive development in his power to imitate and reproduce the consonant sounds, after he has begun to speak. It seems to me that we may safely aver that the law of the evolution of the nervous system is of great pedagogical importance, since it suggests the natural order which should be followed in training the organs concerned in any complex co-ordinated movements. For instance, it is transgressing the laws of nature to emphasize the training of the

[1] *Addresses and Proceedings, International Congress of Education,* 1893, p. 743.

fingers before the neuro-muscular mechanisms of the hand, arm, and shoulder have become thoroughly organized, and their respective movements been brought under control; or to attempt to teach a child to read aloud before he has learned to speak plainly and readily. Dr. H. Gutzmann declares that in fully half of the children who enter school the power of speech is undeveloped."

Errors in Teaching Arithmetic.—The law has been grossly violated in the teaching of arithmetic. While the young child is able to acquire concepts of number and its relations through concrete and objective teaching, he is entirely unprepared for the abstract reasoning. Teachers often require the child to talk about profound number concepts only possible of comprehension by adults and require him to tattle the forms of reasoning. But it is a delusion to think that the child really grasps the abstractions. His knowledge is confined to what he gains through imagery of concrete relations and to a purely mechanical memory of processes that he has learned. In a good many schools the experiment has been tried of omitting all formal arithmetic during the first two years of school. All experiments have shown that children who omitted the formal work were just as well advanced in arithmetic by the end of the fourth year as those who had taken the subject four years. Of course, number concepts and easy processes of addition, subtraction, multiplication, and division should be acquired. The former must be learned through sense perception and imagery, the latter largely mechanically. Reasoning processes should be deferred until the child's brain cells and association fibres have developed sufficiently. We know that a child begins to walk when the zones controlling locomotion are mature, to talk when speech centres become functional, and it is no less certain that complex reasoning processes must await the proper development of the frontal cerebral lobes and the proper association fibres.

Order in Geometry.—Spencer pointed out a very important truth in the teaching of geometry, which unfortunately is too

little known and heeded. He observed that most geometry taught to boys first is the demonstrative type. Deduction is a mental method which develops late. Induction is the fundamental method, deduction accessory. Before taking the ordinary demonstrative, deductive geometry the child should have an opportunity to study form and space relations, objectively, concretely, arriving at many conclusions the truth of which he cannot then fully test but which must be reserved for later consideration. Paper-cutting, cardboard work, moulding, modelling, constructing from various materials, drawing, measuring, superimposing, etc., should find large place in the elementary curriculum. There is no reason why the concepts of two-thirds of the various geometric forms, magnitudes, and relations usually learned in the high school should not become familiar in the elementary and grammar-school course. Demonstrative work should be reserved for much later consideration.

Mistakes in Teaching Grammar.—In teaching grammar a similar mistake has been committed. Grammatical abstractions have been forced upon children at a time when their minds were prepared only for concrete ideas. We have forgotten that grammar is the science of language and that science is a subject for mature minds only. Language as a means of communicating and receiving ideas has been a very fundamental accomplishment in the race. In the individual's development it is likewise exceedingly fundamental. The science of language—grammar—has been very accessory both in phylogenetic and in ontogenetic development. The school-master should heed this. From three to twelve the child is in a nascent period for acquiring spoken language. During that period a normal child will acquire a mastery of the elements of two or three spoken languages besides the mother tongue. Instead of exercising this instinct and aiding the child to acquire what is fundamental to a scientific knowledge of grammar, we arrest development both by failing to give appropriate opportunity and also by premature attempts to develop powers that are as yet largely germinal.

Spencer regards as an "intensely stupid custom, the teaching

of grammar to children." He regards grammar as "not the stepping-stone but the finishing instrument," and says that "Grammar and syntax are a collection of laws and rules. Rules are gathered from practice; they are the results of induction to which we come by long observation and comparison of facts. It is, in fine, the science, the philosophy of language. In following the process of nature, neither individuals nor nations ever arrive at the science *first*. A language is spoken, and poetry written, many years before either a grammar or prosody is even thought of. Men did not wait till Aristotle had constructed his logic, to reason. In short, as grammar was made after language, so ought it to be taught after language: an inference which all who recognize the relationship between the evolution of the race and of the individual will see to be unavoidable." [1]

Natural Science.—Natural science teaching has been very poorly done and the cause has suffered much by failure to detect what has been fundamental in race development and then to apply the law in teaching individuals. Scientific concepts are abstract. They have been wrought out by mature minds and cannot be grasped by the immature minds of children. No wonder that "nature study" has failed to be satisfactory in the schools. Thousands of concrete facts are at hand in which children would be interested if only presented in a manner suited to their comprehension. But many teachers of nature study at the outset seek a book and require children to memorize definitions, acquire statements of concepts beyond their comprehension, and to classify and systematize the subject. All this means the study of abstract science, something which should come much later. The child should acquire sensory knowledge of a wide range of objective facts before he attempts to classify, systematize, and define. When he has something to systematize it will be soon enough to do that. The facts are fundamental, scientific classification is accessory.

Even in the high school the accessories of botany, zoology, and physics are often emphasized instead of the fundamentals.

[1] *Education*, p. 106.

The teacher is frequently one who has acquired all he knows of the subject from books, or being fresh from college he presents his subject from the same stand-point as it was presented to him. In either case the results are disappointing. The teacher of science must be saturated with devices which he has gained at first hand for making the subject alive because concrete and because it is adapted to the stage of development of the particular boys and girls before him. Dr. Hall has inoculated science teachers with a new ideal and everywhere books and teachers are suggesting new points of view. He writes:[1] "The normal boy in the teens is essentially in the popular science age. He wants and needs great wholes, facts in profusion, but few formulæ. He would go far to see scores and hundreds of demonstrative experiments made in physics, and would like to repeat them in his own imperfect and perhaps even clumsy way without being bothered by equations. He is often a walking interrogation-point about ether, atoms, X-rays, nature of electricity, motors of many kinds, with a native gravity of his mind toward those frontier questions where even the great masters know as little as he. He is in the questioning age, but wants only answers that are vague, brief, but above all suggestive; and in all this he is true to the great law that the development of the individual in any line of culture tends to repeat the history of the race in that field.

"Last, and perhaps most important of all for our purpose to-day, the high-school boy is in the stage of beginning to be a utilitarian. The age of pure science has not come for him, but applications, though not logically first, precede in the order of growth and interest the knowledge of laws, forms, and abstractions. He would know how the trolley, how wired and wireless telegraphy work, and the steam engine, the applications of mechanics in the intricate mechanisms, almost any of even the smaller straps and buckles in the complex harnesses science has put upon natural force, charm him. Physics in the field, the street, the shop, the factory, the great triumphs of engineering

[1] *Adolescence*, vol. II, p. 156.

skill, civil, mining, mechanical, inventions in their embryo stage, processes, aerial navigation, power developed from waves, vortexes, molecules, atoms, all these things which make man's reaction to nature a wonder book, should be opened to him; and, in frequent conversations and copious information, we should arouse his imagination, for this is the organ of the heart and opens up the way for reason. The boyhood of the great makers of physics and astronomy, who have found out and opened a natural way for their own genius, is a lesson which most teachers of physics, I fear, have not enough profited by. The subject-matter of their curriculum is too condensed, too highly peptonized for healthful assimilation; and we are too prone to forget that we can only accelerate nature's way, but never short-circuit it without violence."

Fundamentals in Music.—Music teaching in the schools, though rapidly being placed on a more natural basis, was for a time in great danger of being a menace instead of a blessing. As soon as it was given a place in the schools, teachers began to provide ultra-logically arranged courses. They sought for text-books to put in the hands of the children, and the publishers, with an eye to business, immediately provided them. The method became hypernormalized, and was in great danger of becoming thus crystallized, when child-study experts raised their voices in protest. Thanks to the new doctrines, a more scientific view-point has been glimpsed by many music supervisors and music bids fair to occupy an important place in education.

According to the logical method, children are first required to learn note reading—the science of music. They are even required to write music. For these kinds of work they are wholly unprepared. While they are right in the nascent stage for learning to sing songs by rote—to make music a means of emotional expression, in many schools they are given no opportunity to do this until after mastering the science. The result is that under such methods few ever acquire any taste for expressing themselves in song. Children should be allowed and encouraged to lift up their hearts and voices in joy, praise, and thanks-

giving. The beginning of musical education should be in allowing the child to make a joyful noise unto the Lord! The most cursory observation of plantation negroes should tell us what is most fundamental in music. The wonderful results attained by that apparently hap-hazard method ought to give us food for reflection. In Germany no factor so much as early training in singing has contributed to the development of fealty to fatherland. Everybody is encouraged to sing—school-children, university students, soldiers, sailors, the peasants in the fields—all sing. People have sung for ages. All primitive peoples sing. Rhythmic motion and song are among the most primitive fundamental forms of social expression. Written music is a very late invention—relatively accessory. Education should heed the lesson. Most assuredly children should have an opportunity to learn the science of music as well as the sciences of arithmetic, grammar, and physics, but like those it should come after the fundamental facts have been acquired as an art. In many schools the order of procedure has been, and is still being, reversed. Happily, a better movement has begun.

Drawing.—Drawing is another subject in which the natural order of development has been violated. The system in vogue until a few years ago was one based wholly on logical considerations. The first exercises consisted of the attempt to construct a straight line. After practice on isolated straight lines, combinations were made into a surface drawing, and later a representation of a solid. Curved lines were taken up similarly and the various isolated elements synthesized into combinations of some sort. Usually for a long time the combinations represented no particular object, sometimes purely conventional designs. No attempt at representing objects was permitted until all the elements were supposedly mastered. That is, the grammar of the science was the starting-point; the use of drawing as a mode of expression of ideas was the end to be later achieved. That few ever became artists under this system, and that many became disgusted, is well known by those who participated in it.

At the present time, thanks to child study, the whole viewpoint is changed. A study of the art of primitive peoples and of children shows conclusively that the art impulse develops genetically, not logically. The savage man and the child begin pencilling, not because they wish to study the science of drawing, but because they have something in their minds which they wish to express. Ideo-motor processes growing out of visual images prompt them almost reflexly to utilize drawing as a means of expression. Here is the starting-point. First a rude pencilling of something which they are prompted to express; a representation of an object-whole—imperfect at first, of course. Just as in learning to walk and to talk the child does not begin analytically, he does not begin analytically to draw. This comes later when he studies the processes scientifically. Teachers of writing have also hindered the progress of children and created distaste by analyzing the letters altogether too early and requiring perfection before employing writing as a means of expression. Spencer pointed out the absurdities and vices of teaching drawing by the logical method. He wrote:[1] "It has been well said concerning the custom of prefacing the art of speaking any tongue by a drilling in the parts of speech and their functions, that it is about as reasonable as prefacing the art of walking by a course of lessons on the bones, muscles, and nerves of the legs; and much the same thing may be said of the proposal to preface the art of representing objects by a nomenclature and definitions of the lines which they yield on analysis."

In illustration of the whole sequence of development, Spencer has given us a few suggestive principles of procedure, which have been widely quoted, but unfortunately too little understood. They are the following:[2]

1. *Proceed from the simple to the complex.*—He says that like everything else, the mind grows from the homogeneous to the heterogeneous. Only a few of the mind's powers are active at first. The others unfold gradually. Consequently, instruction should begin with the simplest elements and gradually include

[1] *Education*, p. 144. [2] *Education*, p. 120.

additional ones. All these elements should be carried on abreast. Or, as Comenius contended, the elements of all subjects should be begun early and gradually widened in their extent and complexity. This is approximately the spiral plan of the Germans.

2. *Instruction should proceed from the concrete to the abstract.*—He says with truth that "unfortunately there has been much misunderstanding on this point. General formulas which men have devised to express groups of details, and which have severally simplified their conceptions by uniting many facts into one fact, they have supposed must simplify the conceptions of the child also; quite forgetting that a generalization is simple only in comparison with the whole mass of particular truths it comprehends—that it is more complex than any one of these truths taken singly—that only after many of these single truths have been acquired does the generalization ease the memory and help the reason—and that to the child not possessing these single truths it is necessarily a mystery." He shows how teachers continually err by setting out with "first principles" rather than with examples which should lead up to the principles. Rote teaching, giving of rules and generalizations before facts and processes out of which general notions or concepts are elaborated, as Spencer hinted, is altogether too common a procedure. "General truths," he wrote, "to be of due and permanent use, must be earned." They must be born in each individual's own mind and grow out of the individual experiences acquired through the learner's self-activity.[1]

[1] See further the chapter on "Induction," and McMurry's *Method of the Recitation.*

CHAPTER VIII

INSTINCT IN RELATION TO EDUCATION

Illustrations and Meaning of Instinct.—It is a matter of common observation that the lower animals perform many activities without any previous training on the part of the individual. These activities apparently are performed in a definite and uniform manner by all members of the species. Among typical illustrations we may cite the beaver building its dam when of a certain age, at a certain time of the year, and in a tolerably definite manner. The wild-goose migrates southward every year, and again in the spring its well-known honk may be heard as the flock seeks northern latitudes. Honey-bees build their comb in an apparently invariable way from year to year; wasps, bumblebees, yellow-jackets, hornets, each have characteristic ways of constructing their nests and of gathering food. Birds of a given species build nests peculiar to themselves; dogs bury bones; hyenas are ever vigilant; cats play with captured mice; cattle, deer, and other animals, are afraid of red objects, etc. Many animals possess at birth, or almost immediately after, fully developed reactions for food-getting, and many exhibit very early attempts at self-protection from supposed foes. The foregoing activities are denominated as instinctive, and instinct may be defined in a preliminary way as follows: Instinct is an inborn tendency on the part of a given individual to act in a certain way under given stimuli without any foresight (necessarily) of the end to be accomplished, and without any previous education on the part of the individual.

Marshall[1] has given the following discriminating definition: "Instincts are forces within us which are organic, which appear

[1] *Instinct and Reason*, p. 68.

in us because we are organisms; which lead us to undertake, without forethought, actions of a very complex nature involving the movement of many parts of the body in relations which are more or less fixed, actions which, as the biologists say, are more or less thoroughly co-ordinated." He illumined the question still further by saying [1] that, "Our instincts are springs of action which exist within the organism: our instinct actions occur because we are organisms, and because as organisms we inherit with our organic structure habits of action which lead to the attainment of certain ends which have significance for the organism; and we inherit these habits in general because our ancestors have become better adapted to their environment in consequence of the recurrence of these tendencies to act in certain specific ways upon the appearance of appropriate stimuli."

Paulsen wrote of instinct: "The bee knows nothing of the brood of winter, and has no insight into the processes of nutrition; she is guided in all her activity, in her search for blossoms, the construction of her cells, the feeding of her offspring, by perceptions and traces of recollection, which are represented physiologically as nervous processes and dispositions." [2] In other words, instincts are race habits, impulses, or tendencies toward activity in a given direction because of ancestral experience which has become so implanted in the race as to make its appearance in the individual a matter wholly reflex in character. The animal acts in a given way because its nervous mechanism functions in a predetermined manner.

Not Individual Education or Prevision.—It is a popular notion that animals which exhibit instincts possess a clear foresight of the ends to be accomplished. "If the bee did not know that it must store up honey for a certain purpose, why should it be so diligent?" "Why should the beaver build its dam if not for definite self-protection and for protection of the expected young?" "Why should the ant store up food except for the long winter?" (It is not because the ant is lethargic all winter and

[1] *Instinct and Reason*, p. 219. [2] *Introduction to Philosophy*, p. 114.

needs no food.) Apparently common sense has a case against us. But we could cite much evidence to show that the same animals perform instinctive actions when there is absolutely no possibility of such foresight. Among cases which show the utter irrationality of instinctive actions the following are typical: Well-fed domesticated dogs will bury bones, old shoes, etc., when no necessity exists for providing against future contingencies. They will do these things without having had a chance to imitate other dogs. As all farmers know, hens will often spend much valuable time in sitting for weeks upon a rude nest with a china egg and acting as important and cross as if the mother of a brood of a dozen. Hens hatched in incubators and without opportunity to imitate the act will perform it just as certainly and naturally as if such opportunity had existed. Now were the act rational and not reflex no hen would exhibit such stupidity. Its organism was simply keyed in a certain manner and it had to act in harmony with such demands.

Lloyd Morgan cites the case of the Yucca moth, which performs certain activities but once in a lifetime and those without any possibility of education. The insects emerge from their chrysalis-cases just when the flower opens, each for a single night. From the anthers of one of these flowers the female moth collects the golden pollen and in the pistil of another deposits her eggs among the ovules. The action seems to be the result of foreknowledge. This fertilization of the flower is as necessary as the fertilization of clover blossoms by bumblebees. "These marvellously adaptive instinctive activities of the Yucca moth are performed but once in her life, and that without instruction, with no opportunities of learning by imitation, and, apparently, without prevision of what will be the outcome of her behavior; for she has no experience of the subsequent fate of the eggs she lays, and cannot be credited with any knowledge of the effect of the pollen upon the ovules." [1] There are numberless cases of insects which pass through various metamorphoses, that perform perfectly and almost invariably certain activities, although

[1] *Habit and Instinct*, p. 14.

none of a given generation have ever seen any of a preceding generation.

Habits, Reflexes, and Instincts Compared.—A habit is a resultant of the education of the individual, while instincts are the resultants of accumulated race experiences. These experiences are conserved and accumulated through natural and artificial selection and, according to eminent authorities like Romanes, through the transmission of acquired characters. This last view is as strongly denied by able men like Weismann. To produce a habit the individual must repeat a given series of actions a sufficient number of times to establish an easy pathway of discharge in the nervous system. Instinctive tendencies often have a marked influence in facilitating the formation of some habits.

Reflex action is non-voluntary and usually controlled by lower centres of the nervous system and not by the higher brain centres. I touch a hot stove. An impulse is sent toward the cortex, but when it reaches the spinal cord a current there generated innervates the muscle, causing me to withdraw my hand. In reflective, voluntary action the higher brain centres are brought into requisition. In a reflex the response to a stimulus is indefinite. The reaction may be for the good of the individual or it may not. It may or may not accomplish an apparently determined end, as in winking to avoid injury to the eye. The line of demarcation between the two is not sharply drawn. Undoubtedly many apparently purely individual reflexes have much of the instinctive element in them, and all instinctive actions are of the reflex type. Spencer has denominated instinct as compound reflex action. According to this interpretation the difference may be explained in the words of Lloyd Morgan: "Reflex acts are local responses due to specialized stimuli, while instinctive activities are matters of more general behavior and usually involving a larger measure of central (as opposed to merely local or ganglionic) co-ordination, and due to the more widely spread effects of stimuli in which both external and internal factors cooperate."

"It would seem, therefore, that, whereas a reflex act—such, for example, as the winking of the eye when an object is seen to approach it rapidly—is a restricted and localized response, involving a particular organ or a definite group of muscles, and is initiated by a more or less specialized *external* stimulus; an instinctive activity is a response of the organism as a whole, and involves the co-operation of several organs and many groups of muscles. Initiated by an external stimulus or a group of stimuli, it is, at any rate in many cases, determined also in greater degree than reflex action by an internal factor which causes uneasiness or distress, more or less marked, if it do not find its normal instinctive satisfaction." [1]

Instincts not Invariable.—It has been a popular notion that instincts are fixed and invariable in a given species in all its individuals and through successive generations. Nothing could be further from the truth. Instead of coming ready-made once for all, we find that they are products of evolutionary forces. They come into existence, are subject to modifications, and may atrophy or decay, leaving only vestigial evidence or none whatsoever of their existence.

Marshall says that: [2] "The definiteness and the invariability of the co-ordination of these actions are relative definiteness and relative invariability only. This became evident when it was noted that the efficiency of many instincts even of the lower types depends upon the trend of the activities they induce even where there is a certain degree of variation in circumstances of stimulation, or in the stimuli themselves, and consequently in the reactions to these stimuli. The reader will remember that we illustrated this fact by recalling to his mind the variations of action and co-ordination noted in the young chick in its instinctive search for food supply; the general end being reached through slightly varying co-ordinations of action.

"It will also be remembered that as we studied instincts of a higher type we found less definiteness and invariability of reaction, and a marked preponderance of cases where the

[1] *Habit and Instinct*, p. 7. [2] *Instinct and Reason*, p. 219.

guidance of our actions to the production of certain ends is attained by the strengthening of *trends* of action which come to persist through many differences of stimulation and through many variations of reaction."

Genesis of Instincts.—Instincts are impulses resulting from the conservation of habits through heredity. Any memory implies habit in the making. The fact of the preservation of a tendency to react at a subsequent time in a way that the organism has acted before is the beginning of a habit. If the activities are repeated a sufficient number of times a genuine habit is formed. This habit means a reflex tendency to react in a similar way at subsequent times on similar occasions. If the habit becomes thoroughly ingrained and children are born subsequent to its formation, the tendency is transmitted. This hereditary tendency or impulse is an instinct. If the given habit becomes wide-spread in the species and important to their existence, it comes in time to be a race habit, or, as it has been denominated, an instinct. All habits are in fact pseudo-instincts, as Marshall has termed them.

It is not necessary that habits become universal in a species in order to become instinctive, although the universality of possession of a habit is a general criterion of an instinct. There are what may be termed race, national and family instincts. These are characteristics sufficiently universalized to produce the hereditary tendencies in a given line of descent. We speak with perfect psychological propriety of the phlegmatic German, the emotional Frenchman, the stoic Indian, etc. Similarly we may recognize instinctive family tendencies. These are often so strong as to mark a given family in a striking manner. Because of the origin of instincts it follows, even, that each individual has some instinctive tendencies peculiar to himself. The streams of heredity have united in such a way as to make the resultants peculiar to each individual. In fact no two individuals are exactly alike. Their instincts function at varying times, in different degrees of power, are modified by education in different ways; in fact, present manifold un-uniformities.

Instincts Modified through Environment.—Although the functioning of instincts is primarily dependent upon the maturity of the organism which causes at the proper time impulsive promptings to action, yet the influence of environment must not be overlooked. The time of building the honeycomb, the time when the beaver builds its dam, the time when the wild-goose will fly northward, the time when the parental instincts are to manifest themselves, are mainly inherent within the organisms themselves. The organisms are in a measure like machines with time alarms. When development has reached a certain point, when the springs have been compressed to a certain tension, release is sure to occur. However, environment may hasten, retard, or even entirely inhibit functioning. The kind of weather, altitude, latitude, amount of sunlight, moisture, etc., all affect the time of flowering and the fruiting periods of plants. Climate, latitude, and conditions of nutrition affect the time of maturity in animals and human beings. It is well known that peoples in torrid zones mature and decline earlier than in temperate zones. The difference between the ordinary worker bees and the queen of the hive is largely one of nutrition. All the workers possess potentialities which if nourished would have caused them to develop into maternal bees. Within the first eight days of existence the larvæ destined to become workers could by such feeding as the queen larvæ receive, be developed into sexually-perfect queens, capable of reproduction. When a queen dies, the workers by royal feeding develop a queen from worker larvæ. The potentialities of either worker or queen are inherited, and the particular development is determined by a little more or less nourishment.

House martens now build their nests beneath the eaves of houses while formerly they lived in rocky haunts. Barn swallows also build their mud abodes beneath the eaves of barns. This they cannot have done long because barns are a modern invention. Chimney swallows must have had a different method of nest-building before the invention of chimneys. Domestic ducks in Ceylon have lost their former natural love for water

and are entirely terrestrial in their habits, while some other ducks have been known to forsake their marshy haunts and build their nests in trees, bringing their young to the water on their backs. Certain species of Australian parrots that were honey-feeders have become fat-feeders since the development of the sheep industry which enables them to prey upon the carcasses of dead sheep. They have learned to select unerringly certain portions of the carcass which afford the choicest morsels. The polar bear has learned to bite its prey instead of hugging as other bears do. Many transformations in process in whales, seals, dolphins, etc., were alluded to in a former section.

Darwin said apropos of this:[1] "Hardly any animal is more difficult to tame than the young of the wild rabbit; scarcely any animal is tamer than the young of the tame rabbit; but I can hardly suppose that domestic rabbits have often been selected for tameness alone; so that we must attribute at least the greater part of the inherited change from extreme wildness to extreme tameness, to habit and long-continued close confinement."

Modification of Instincts through Education.—The domestication of wild animals affords a vast array of most important illustrations of the transformation of habits, instincts, and even of structure. The testimony should be very suggestive of the possibilities of race transformation in the human species. Domestic horses have lost most of their primitive wildness and the new instincts of docility render them of inestimable service to man. The cat in its wild state is one of the fiercest and most untamable of creatures, but once domesticated it is one of the gentlest, and most attached to man. It is a far cry from the fierceness and restlessness of the wolf and the jackal to the domestic dog, but the ancestry of the latter can easily be traced to the former. Contrast the sneaking, ferocious denizens of the forest with well-bred shepherd or Newfoundland dogs which display such affection, fidelity, and sagacity in protecting the interests of their masters. Even among domestic dogs we find great plasticity and variability of instincts and structure—all

[1] *Origin of Species*, p. 211.

the result of definite attempts to produce and conserve desirable characteristics. Think of the special instincts of the Newfoundland as compared with the greyhound; those of the collie with pointers and setters; and each of these as compared with pugs, poodles, and terriers. Each shows the results of generations of education, conservation, and selection.

Should there be any tendency to raise objections that many of these special characteristics are the result of individual training rather than instinct, it must be emphasized again that the special tendencies of different breeds show themselves unfailingly even when the dogs are isolated from all others when young. Romanes shows conclusively how young coach-dogs will spontaneously run around and bark at horses, how pointers will point, and setters will set. He even shows how special traits come to be inherited in particular families of dogs. He quotes from Darwin's MSS. the following: "The Rev. W. Darwin Fox tells me that he had a Skye terrier which when begging rapidly moved her paws in a way very different from that of any other dog which he had ever seen; her puppy, which never could have seen her mother beg, now when full grown performs the same peculiar movement exactly in the same way." [1] In speaking of the tumbling instinct peculiar to certain pigeons, he remarks much to the point: "It would be as impossible to *teach* one kind of pigeon to tumble as to *teach* another kind to inflate its crop to the enormous size which the pouter pigeon habitually does." [2] In time the world will come to understand that functions, and among them instinctive functions, are as distinctly heritable as structures, and moreover, that they begin, grow, and develop in precisely the same way.

Instincts and Intelligence in Animals.—Although the lower animals possess a large number of ready-made instinctive reactions which they utilize in their life activities, yet it must not be concluded that all their actions are blind and that nothing of rationality is manifested. Instincts are the fundamental guiding powers, but intelligence, often of a high degree, modifies and

[1] *Mental Evolution in Animals*, pp. 186 and 189. [2] *Ibid.*

to some extent determines the particular direction in which the action shall issue. Even the lowest animals add to instinct through education which the vicissitudes of environment make necessary. This education further lays hold of and, to some degree, controls the instincts. Of course, the types of reaction are determined by latent potentialities, but the details often exhibit great inhibition and control. Romanes's entire volume on animal intelligence is a forceful argument against the theory of blind instinct dominating the life of the lower animals. Many marvellous adaptations which could only result from intelligence are recorded by Romanes, Sir John Lubbock, Lloyd Morgan, and many other writers of reputation. Even in man shall we not say that the types of reaction are largely predetermined by race habits? The applications, however, become so controlled by the life of reason and the directions so complex as to obscure their origins.

To show that the instincts of lower animals may be supplemented by intelligence, I quote from some of the observations and experiments of Huber on bees which are cited by Eimer:[1] "Once the bees had made on a wooden surface the beginning of two combs, one to the right, the other to the left, in such a way that the latter should support an anterior, the former a posterior comb, and the two when finished should be separated by the usual distance between two combs in a hive. But the bees found that they had not allowed sufficient distance. What did they do in order to avoid losing the work already done? They joined the beginnings of the two combs into one. The curvature necessarily produced was in the continuation of the comb completely levelled, so that the lower part of the comb became as regular as one properly commenced."

Eimer says further that: "The skill of the garden spider in building her web no doubt depends on instinct, but only with regard to the main process: here also reflection is exercised on many points. In the mere choice of the place where the net is to be spread the spider needs to take many things into consid-

[1] *Organic Evolution*, p. 291.

eration: direction of wind, sunlight, abundance of insects, and, above all, the assurance that the web will be safe from disturbance in the place selected, require a host of intelligent conclusions—the question of security from disturbance alone requires a number. And yet how correctly the spiders usually judge in this very respect."

Wallace is authority for the statement that migrating birds do not fly unerringly to desirable regions. He says:[1] "Thousands annually fly out to sea and perish, showing that the instinct to migrate is imperfect, and is not a good substitute for reason and observation." Romanes remarks that: "Instincts are not rigidly fixed, but are plastic, and their plasticity renders them capable of improvement or of alternation, according as intelligent observation requires." "Thus we see that the oldest and most important instincts in bees and birds admit of being greatly modified, both in the individual and in the race, by intelligent adaptation to changed conditions of life; and therefore we can scarcely doubt that the principle of lapsing intelligence must be of much assistance to that of natural selection in the origination and development of instincts."[2] Conversely it must not be supposed that man acts without instinctive impulses and solely from intelligent guidance. The next paragraph shows very clearly the part played by instinct in man.

Instincts not Confined to Animals below Man.—Instincts are ascribed by the uneducated only to animals. Because man comes into the world a very helpless creature and remains so for such a long period, it is thought that human beings possess no instincts. These traits are thought to be special provisions for the guidance of the animals lower than man. But although man is not limited to habitual reactions, either racial or individually acquired, he possesses even more instincts than other animals. The reason we do not recognize instinctive traits in man is because they are exceedingly complex, rendered so through modification by each other, by habits, and by education.

[1] *Darwinism*, p. 442.
[2] "The Darwinian Theory of Instinct," *Essays*, p. 42.

James has said that man possesses all the instincts of the lower animals and many more. This is not literally true. Even though man were a direct descendant of all the lower animals, we should have to remember that recapitulation is not complete. Many organs and functions have been exercised in the course of evolution. Old instincts have died out and new ones have been born. It would, however, be correct to say that man possesses as many instincts as the lower animals and vastly more. Instincts are simply potencies or impulses which cause the individual to act in particular directions. Abilities in music or mathematics are just as truly instincts as the phenomena of nest-building by birds or the spinning of webs by spiders. Wundt says that "the human being is permeated through and through with instinctive action, determined in part, however, by intelligence and volition." [1]

Human Instincts.—Among the most readily apparent human instincts the following are typical: Sucking, biting, clasping with fingers or toes, carrying objects to the mouth in childhood, crying, smiling, protrusion of the lips, frowning, gesturing, holding the head erect, sitting up, standing, creeping, walking, climbing, imitation, talking, emulation, rivalry, pugnacity, anger, resentment, sympathy, the hunting instinct, migration; a great many fears or phobias, as of high places, dark places, strange objects; acquisitiveness, constructiveness, play, curiosity, gregariousness, bashfulness, cleanliness, modesty, shame, love, parental feelings, home-making, jealousy, pity. The list might be made vastly longer. In fact, man is a great complex of tendencies to acting, feeling, and thinking in a great variety of directions. These impulses are all instincts. Should some one argue that such a phenomenon as speech is not instinctive, but a result of imitation, I would make the rejoinder: "Then why does not my dog learn to speak the same as my child?" They both have the opportunity of hearing and imitating. The very fact that my child learns to speak while my dog does not is evidence that my child possesses a potentiality which my dog

[1] *Lectures on Human and Animal Psychology.*

does not possess. This tendency or impulse is an instinct. Why is it possible for the cat carried miles away in a bag to find its way back unerringly? Or why can the homing pigeon and the bee fly in "bee lines," while we human beings make such sorry mistakes concerning directions? Because the cat, the pigeon, and the bee have potentialities which we do not possess.

Any activities or tendencies to action which are universally possessed by a race or species,—which do not have to be learned by the individuals, or which are learned by individuals with great readiness, may be considered as instincts.

Some Special Human Instincts.—*Vital reactions.*—After having shown how universal and fundamental are instinctive tendencies, an attempt will now be made to indicate something of their educational significance. A few typical instincts will be discussed in detail, but the educational bearings must necessarily be on broad general lines.

Among the earliest human instincts to be exhibited are those of sucking and swallowing. These are absolutely necessary for self-preservation and are about as deep-seated as the automatic cardiac movements, the respiratory and intestinal movements. Some children have been observed to suck the thumb within three minutes after birth. To be sure, sucking and swallowing await the action of a stimulus. Until there is excitation of the proper organs there is no manifestation of the instinctive activity. But is not the same true of pulmonary action, of heart and vascular action, and of intestinal action? The pulmonary muscles and the cardiac muscles do not begin to act until stimulated. Purely physical forces cause the air to fill the vacuum in the nose, mouth, bronchial tubes, and lungs. Thus stimulated, the mechanism, functionally mature, is set in motion. The circulation awaited similar stimulation (about the fifth month of fœtal life). Thus the new life once set in motion beats on, and on, and a prolonged cessation means death. So the apparatus for sucking, functionally mature, awaited the proper stimulus to make it available for self-preservation.

Grasping.—Grasping with fingers and toes is another activity ready to function at birth. New-born infants grasp objects with the hand, and sometimes even with the toes. The ability to grasp with the toes almost dies out through disuse, but the ability to grasp objects with the hand develops because of its great importance as a means of self-preservation. Educationally it is also an important means of knowledge-getting. During the first weeks and months of the child's life he is enabled to get a great many ideas of the various qualities of objects: tastes, hardness, roughness, smoothness, shapes, etc. Distances and sizes are measured by the experience gained in reaching, which is a part of grasping, and in touching. The experiences thus gained are fundamental in all later knowledge of the world of things. The child should be provided with objects whereby this instinct may be exercised. While he is learning to seize more accurately and to grasp more firmly and accurately he is learning many ideas that are basal in later concepts. The sucking instinct and the instinct for putting everything in the mouth, although detrimental in many instances, still aid the little one in his exploration of the material qualities of things. I have noticed a child of seven months exercise much care in carrying a rough pine stick to his mouth. As soon as he begins normally to grasp after things he should be supplied with various objects to handle. This is especially true when he begins to sit alone.

Locomotion.—The instinct for locomotion prompts the child to execute movements which are destined to multiply indefinitely his range of explorations. First by creeping, crawling, rolling, or sliding he manages to propel himself about his limited world. This is, of course, one of those *deferred* instincts which manifest themselves only when functional maturity of the centres involved becomes complete. Through a fear that the child will soil his clothes by creeping, many mothers very injudiciously discourage all efforts at creeping or any other means of locomotion other than walking. Besides being a potent means of strengthening chest-muscles, lungs, arms, and other parts of the body, creeping

is an absolutely necessary means of education. No greater sin could be committed against the child than by curtailing his infantile efforts at personal locomotion. By locomotion the child not only acquires accurate knowledge of hundreds of objects and their qualities, but all the senses are receiving definite training and development. The two requisites for the development of the senses, as noted elsewhere, are proper nutriment and stimulation. If either be lacking or in excess, the results are detrimental. It would, of course, be absurd to try to force upon the child's notice a multitude of sensory impressions. Over-stimulation, such as may be produced by too much playing with children, keeping them up at unseasonable hours, arousing from sleep to exhibit to admiring friends, etc., is positively harmful. It may produce precocity, but the final outcome may be unstrung nerves or arrested development. Too often the baby is played with, in reality to amuse the elders, under the pretext or the mistaken idea that the baby needs amusement. The rule should be to furnish the child sufficient materials to satisfy his capricious interests, but to let the child be the pacemaker. When it is hard work to amuse the baby something besides amusement is needed. The little nerves are probably already overwrought, and rest and quiet, possibly sleep, are needed.

As soon as the child begins to walk, his ideas begin to expand wonderfully. Whereas his sense perceptions were confined mainly to the house through the creeping stage, he now, if properly treated, begins to explore the region round about, sometimes to the annoyance of the neighbors and the embarrassment of his parents. But the only way to understand the world is to travel. The one, child or adult, who sticks by the home fireside always remains provincial and circumscribed in ideas. Children's vocabularies are good indexes of the extent of their explorations. The children who have not seen rivers, hills, trees, birds, cows, and other animals; trains, engines, and mills, do not have these words in their vocabularies. A city child of even three years old increases its vocabulary and its stock of ideas amazingly by

being taken into the country. The country child undergoes the same change by going into city environment. Thus the instinct for locomotion is a most important means to advantageous educational ends.

Expression.—Children often invent gesture language. Deaf-mutes also do so, even when isolated from speaking people. Ribot quotes Gérando as saying that: "Children of about seven years old who have not yet been educated, make use of an astonishing number of gestures . . . in communicating with each other." As a further illustration of this spontaneous, natural language, he says that: "Gérando and others after him remarked that deaf-mutes in their native state communicate easily with one another. He enumerates a long series of ideas which they express in their mimicry and gestures, and many of these expressions are identical in all countries." [1]

This instinct for expression should receive proper attention. As soon as the child manifests a desire to communicate his ideas in speech, his crude, spontaneous, and more deliberative attempts should be encouraged. Instead of mimicking the child in his baby expressions and helping to fix the wrong form in his mind, one should repeat for him the correct form distinctly and encourage the child (not nag him) to imitate. The vocal organs are now ripe for utterance and should be exercised. If the child does not develop the speech organs during this nascent period he will ever be slow, halting, or deficient in the use of words. Certain it is that new words are accumulated with amazing rapidity during this budding period. The two-year-old child has amassed, within a year, from three hundred to twelve hundred words, representing ideas, and may have as many more parrot-words, *i. e.*, sounds imitated without an understanding of the meanings. These latter have been gathered from rhymes, jingles, and from conversation not understood and from chance association of sounds with objects or actions. Now, even these parrot-words are important, for they gradually acquire fulness of meaning. Words are, as Dr. Harris has said, like bags; once

[1] *Evolution of General Ideas*, p. 40.

acquired they hold all the perceptions and reflections that relate to the idea symbolized by the word.

Not only should the child be assisted in enunciation, but his environment should be such as to lead to the production of ideas. Although I do not coincide with the renowned Max Müller that there can be no thinking without words, yet it is doubtless true that the best thinking utilizes words as instruments. The child that is properly environed, who gratifies his appetite for seeing, hearing, and touching things, who is led to think about these things (for thinking does not hurt children), and who is not overstimulated, will as surely acquire words as mature people acquire tools to accomplish their mechanical work.

The instinct of curiosity, the constructive instinct, and the inborn tendency to play, all co-operate in the acquisition of language. The child must see and examine things for himself; he should not stumble upon them all by chance; designedly he should be led to where things are; he must be helped to see them aright; he must have facts told about them; he must be questioned about them; and above all, he must have questions answered that he will surely ask. In this way he will pick up much language; he will have given to him many new words; he will ask terms from you, and he will even coin them for himself.

Curiosity.—The child, through his instinctive curiosity, is a born investigator. Normally he pulls things to pieces to see how they are made and how they go. His unwise elders often condemn what they believe to be innate destructiveness, but he is simply trying to satisfy his craving for knowledge. To keep alive this instinct and further its normal development is high teaching art. Too often before the end of school life the instinct has completely atrophied. To get the college student to desire to know is the most difficult task before the college instructor. Not infrequently before the college is reached all knowledge is taken in prescribed doses and largely because ill consequences are feared if directions are not followed.

Curiosity is a fundamental instinct, observable far down in the scale of animal life. It is apt to be coupled with fear in the presence of strange objects. Who has not seen horses, cattle, sheep, and swine hovering around a newly discovered and strange object, oftentimes walking round and round, hovering in its vicinity, but ever with nerves tense ready to make off with the greatest speed on the discovery of apparently harmful or undesirable signs? Any one who has tried to catch a horse in a pasture by luring him with a pretence of food has received a lasting remembrance of this blending of curiosity and fear. Fowls and birds exhibit the same characteristics. Small children, and even adults, often manifest similar states. I have seen my child of one year cry with fear on seeing an umbrella, but no amount of persuasion could bring her away from its vicinity, so fascinating it seemed. Many adults often flirt with the dangerous and uncanny in the same way. Who has not gone through a dark wood, a dark room, all quaking with fear but curious to ferret out some mystery? Every one would fain take a turn at hunting for spooks in a haunted house. Sully tells us that: "A very tiny child, on first making acquaintance with some form of physical pain, as a bump on the head, will deliberately repeat the experience by knocking his head against something as if experimenting and watching the effect." [1] This is clearly a case of curiosity overpowering fear.

Spencer says: "Whoever has watched, with any discernment, the wide-eyed gaze of the infant at surrounding objects, knows very well that education *does* begin thus early, whether we intend it or not; and that these fingerings and suckings of everything it can lay hold of, these open-mouthed listenings to every sound, are the first steps in the series which ends in the discovery of unseen planets, the invention of calculating engines, the production of great paintings, or the composition of symphonies and operas. This activity of the faculties from the very first being spontaneous and inevitable, the question is whether we shall supply in due variety the materials on which they may

[1] *Studies of Childhood*, p. 225.

exercise themselves; and to the question so put, none but an affirmative answer can be given." [1] Lloyd Morgan gives expression to a coincident opinion where he says: "Herein, then, lies the utility of the restlessness, the exuberant activity, the varied playfulness, the prying curiosity, the inquisitiveness, the meddlesome mischievousness, the vigorous and healthy experimentalism of the young." [2]

Activity and Constructiveness.—A child of six months accidentally knocks two tin cans together and discovers that he has done something. He immediately strives to continue this experiment, and his beaming countenance gives ample evidence of the satisfaction gained. At eight months my child accidentally dropped a teaspoon upon the floor. When the teaspoon was given to the child again, he at once began to exert himself to repeat the dropping process. After that, whenever the spoon was given to him the dropping recurred. Evidently the child's desire to repeat the action was prompted not so much by the pleasurable noise as the satisfaction of doing something. From the time children can walk I have found them anxious to do things that grown-up people do. They are anxious to dust, sweep, wash, iron, bake, make beds, carry things, read, write, and go on errands. They are called lazy a little later on, but I believe that a normal healthy child has not a lazy fibre in its make-up. Its muscles, nerves, and senses are hungry for exercise, and every effort is made by the child to satisfy these cravings. The child may be lazy in the sense that your particular kind of occupation may be repugnant to him, but if you watch the little feet trot all day you can hardly have the heart to call him lazy.

Constructiveness is a fundamental instinct of so much importance as to merit special consideration. All children early exhibit tendencies toward making things. I have noticed a child of seven months trying to place one block upon another in imitation of other children. Miss Shinn tells us that her niece as early as seven months would not listen contentedly to older

[1] *Education*, p. 128. [2] *Habit and Instinct*, p. 162.

persons playing the piano, but that she was satisfied only when trying it herself.[1]

In these inborn tendencies to activity and constructiveness are the teacher's and parent's golden opportunities. The parent should encourage the little ones to help. In this way the work *habit* will be instilled, and by the time the child is five years of age it may save its mother many steps every day. It can pick up and put away its own playthings, and run on errands (I have known four-year-olds to go half a mile and purchase correctly things from a store and to go daily for little grocery orders in the near neighborhood). Most children are born carpenters; that is, the love of carpenter's tools is well-nigh universally manifested among healthy children. They want to hammer, and saw, and *make*. A child can have no more useful educative appliances than a hammer, some nails, and boards into which he may have full liberty to drive the nails. I have noticed children of two years amuse themselves in this way for hours at a time. They may not develop into carpenters when grown up, but they have gained an education through the process. It is a pity that children cannot have a set of tools and that instead of having all their toys, sleds, carts, etc., made for them they are not allowed and encouraged to construct them for themselves.

James has put the matter very aptly in the following paragraph: "*Constructiveness* is the instinct most active; and by the incessant hammering and sawing, and dressing and undressing dolls, putting of things together and taking them apart, the child not only trains the muscles to co-ordinate action, but accumulates a store of physical conceptions which are the basis of his knowledge of the material world through life. Object teaching and manual training wisely extend the sphere of this order of acquisitions. Clay, wood, metals, and the various kinds of tools are made to contribute to the store. A youth brought up with a sufficiently broad basis of this kind is always

[1] *Notes on the Development of a Child*, p. 116. (The entire volume is rich in suggestions concerning the early activity and instinctive constructiveness of children.)

at home in the world. He stands within the pale. He is acquainted with Nature, and Nature in a certain sense is acquainted with him. Whereas the youth brought up alone at home, with no acquaintance with anything but the printed page, is always afflicted with a certain remoteness from the material facts of life, and a correlative insecurity of consciousness which makes of him a kind of alien on the earth in which he ought to feel himself perfectly at home. . . . Moreover, . . . how important for life,—for the moral tone of life, quite apart from definite practical pursuits,—is this sense of readiness for emergencies which a man gains through early familiarity and acquaintance with the world of material things. To have grown up on a farm, to have haunted a carpenter's and blacksmith's shop, to have handled horses and cows and boats and guns, and to have ideas and abilities connected with such objects are an inestimable part of youthful acquisition. After adolescence it is rare to be able to get into familiar touch with any of these primitive things. The instinctive propensions have faded, and the habits are hard to acquire.

"Accordingly, one of the best fruits of the 'child-study' movement has been to reinstate all these activities to their proper place in a sound system of education. *Feed* the growing human being, feed him with the sort of experience for which from year to year he shows a natural craving, and he will develop in adult life a sounder sort of mental tissue, even though he may seem to be 'wasting' a great deal of his growing time, in the eyes of those for whom the only channels of learning are books and verbally communicated information." [1]

Play.—The educative value of the play instinct has been recognized by kindergartners since the time of Froebel. It has recently received much study by others, and undoubtedly is a means of intellectual and moral discipline. I believe that both free play and regulated play whose ends are certain discipline, are valuable. In the first five or even six years the play should be almost entirely free play, without adult restrictions imposed

[1] James, *Talks to Teachers on Psychology and Life's Ideals*, p. 146.

upon it. In the first place, the tonic effects of play upon the nervous system are of great moment. When mental exercise has been engaged in which absorbs one part of the brain only, free play causes what Warner designates as "augmenting, spreading movements" of nervous energy. The spontaneous play calls into action fresh brain areas and the successive discharges from one centre to other centres serve to reinforce the nerve currents as they proceed to the muscle which produces visible action. A good laugh, which usually accompanies free play, being a series of acts commencing with small muscles and ending with the large ones, may completely change the previous mode of brain action.[1] To remove temporary fatigue there is absolutely no substitute for the good old-fashioned recess, with its laugh and shout and capering wildly about.

Play, then, during the early stage of childhood before the child has gained control over the accessory muscles should be largely spontaneous and unrestricted. I say largely, because even then something may be done to regulate and direct play which does not involve fine co-ordinations. The kindergarten games which include movements involving the larger muscles of the trunk, those controlling the head, arms, legs, etc., may be engaged in to great advantage. These should have in view the exercise of the *social instincts*. Many little social duties and amenities may be thoroughly inculcated in children through play which is organized and directed by the teacher. My children had a birthday party the other day. The whole direction of the affair was given by the mother. They were helped to arrange the little table, were assigned places, given a few directions, and through imitation of others they carried out the rest of the program. Now the little games which the kindergartner directs (though she may seem to be asking their advice) are of immense value in helping children through imitation and obedience to learn the fundamental laws of society. These plays should certainly be well adapted to the capacity of the children, never predominantly inhibitive or restraining, rather the re-

[1] See Warner, *Mental Faculty*, p. 116.

verse. But enough of control should be sought to lead the child to form habits of self-control. It must be done by easy gradients. It is like gradually training the colt by accustoming him early to the halter, to being led, and to being bridled, so that when his colt-hood is ready for the harness he needs no "breaking." The entirely unrestrained child is like the wild horse; subsequently he may be broken but is never safe. A violent outbreak may be expected at the least unusual occurrence. It has been shown by several writers that many boys' organizations (baseball teams, etc.) do not hang together well but go to pieces on slight provocations. Bryan concludes from this that therefore play up to about twelve years "should be unhampered, spontaneous and careless of ends." While I recognize the fact that children do not hold together in "team work" of themselves, I should be inclined to attribute it to the very fact that childhood cannot produce leadership. In Professor Bryan's own words in the same article: "Unquestioned obedience to rational, intelligent authority should be the principle in the management of young children, and freedom from this principle will increase with the development of the child." [1]

From a considerable observation of kindergarten games and household games of children, I am led to believe that their enjoyment is in no wise curtailed by wise direction, and certainly the educative features derived are much superior to the play that is entirely "careless of ends." The child in his spontaneous play is not always "careless of the end." My little girl of five goes coasting, and of her own free will and with no instruction save imitation and experience has learned to steer the sled almost as skilfully as an adult. Children of eight or ten often learn to skate beautifully, learn to ride bicycles in a manner that puts to blush the adult, and it is all play to them. Now provided they enter into organized games with the same zest, and I believe they may, why is it not as much play when directed? It should be no more hurtful to the child to cheerfully obey simple directions in a kindergarten game than to learn "pat-a-cake," to

[1] *Ped. Sem.*, vol. VII, p. 380.

learn to button his own clothes (which my children have begged to do), to learn to hold a knife and fork properly, to maintain reasonable silence in presence of company and at the table, etc.

The social instinct is one that early exhibits itself. The babe of a few weeks old shows signs of lonesomeness when left alone, especially if it has been much tended. By the time the child is five or six months old absence of accustomed members of the family, especially children, causes no little irritability. Perhaps a caution may be thrown out against over-stimulation of the immature nerves during the early days of childhood. If allowed too much companionship, although he enjoys it, the child may become irritable and his normal growth be seriously hindered. By the sixth month the child may safely watch other children at play for some hours daily. A little later on he will take a hand in playing with objects on his own account. The child should be the one to manifest a desire to play with things. This is first exhibited by grasping as indicated above. Too often, however, things are forced upon him by nurses who seek to keep him quiet by continually increasing the stimuli. The more the child frets the harder they toss, and pat, and pinch, and tickle, and talk, and sing. What the babe needs under such symptoms is something that will act as a sedative, *i. e.*, to be left alone and to have quiet around him.

The social instinct furnishes a starting-point for the complete training of the individual for his place in society. The laws of the *socius* can be learned only by being in social organizations. A child isolated from the world grows up a social monster, because of the abnormal development of his selfish nature. Rousseau taught that man is by nature a pure being becoming corrupt by contact with artificial society. Therefore he isolates Émile from his fellows from birth to manhood. But such an individual could not live in society because he has found no place in it. Law and order, the basis of our social fabric, are meaningless to him. Hence the child must learn the fundamentals of social organizations by subjecting himself to the

restrictions imposed by society for the benefit of the whole and the individuals composing the whole.

The family is the first to impose restrictions and extend privileges. Instinctively the child learns about the family organization and also instinctively imitates their reactions toward one another. By this undesigned process the child unconsciously forms numberless habits, which will be priceless to him through all his life. He learns, or should learn, how to treat his parents, brothers and sisters, strangers, how to behave at the table, not to disturb family or neighborhood peace, etc. But even this would leave him undisciplined in multiple essentials of the relationships imposed by society at large. There is the school toward which the child instinctively yearns to go. I believe all children want to go to school not because it is school, but because many children are there. Now, too early formal school work is injurious, but there is the kindergarten and if properly conducted it is a blessing to all children. There the children can assemble and under pure, wholesome influences, through exercises appealing to the instincts of sociability, expression, and constructiveness, learn through play some of the most valuable lessons of their lives. Children of the most disagreeably selfish dispositions may there with little or no coercion develop the control and proper emotional attitude for most amiable actions. Through imitation of their fellows, they learn to do many things which could not be beaten into them, and they drop many habits which could never have been beaten out of them.

Reign of Law in Psycho-Genesis.—The great contribution of evolution has been in rendering a new interpretation of the origin of present modes of activity. Instead of regarding any action as causeless or as supernatural, it finds an explanation of the present in the records of the past. Dr. Stanley Hall in particular has given an entirely new meaning to education. His great admonition is to study the actual child of to-day if we wish to develop an ideal man of to-morrow; and if we would know the real child of to-day, we must not only view him as he is, but we must know him historically. The paleo-psychic

records of race growth must be searched diligently to know how the child of to-day came to be what he is. Then only are we ready to plan for the morrow. Otherwise our blunderings may cause only arrests, retardations, and malformations.

He says:[1] "Man is not a permanent type but an organism in a very active stage of evolution toward a more permanent form. Our consciousness is but a single stage and one type of mind; a late, partial, and perhaps essentially abnormal and remedial outcrop of the great underlying life of man-soul. The animal, savage, and child soul can never be studied by introspection." Dr. Hall has emphasized more strikingly than any one else how each individual comes into the world freighted with all the influences of the past. Though each rational being undergoes great modification, yet the initiation of most phenomena of the present has its origin in the remote past and can only be understood by comprehending that past. Evolutionary history is the key to the understanding of the present and no great progress in education can ever be effected without the prophecy made possible by revelation of what and how the present came to be. He further writes: "We must go to school to the folk-soul, learn of criminals and defectives, animals, and in some sense go back to Aristotle in rebasing psychology on biology, and realize that we know the soul best when we can write its history in the world, and that there are no finalities save formulas of development. The soul is thus still in the making, and we may hope for an indefinite further development. . . . There are powers in the soul that slumber like the sleepers in myth, partially aroused, it may be, in great personal or social crises, but some time to be awakened to dominance. In a word, the view here represents a nascent tendency and is in striking contrast to all those systems that presume to have attained even an approximate finality." In his classical study of fears,[2] Dr. Hall also wrote: "We must assume the capacity to fear or to anticipate pain, and to associate it with certain objects

[1] *Adolescence*, I, vii.

[2] *Am. Jour. of Psych.*, vol. VIII, p. 245.

and experiences, as an inherited *Anlage*, often of a far higher antiquity than we are wont to suppose."

In this way he has sought an explanation of the multitude of activities which have hitherto been merely catalogued and regarded as static or supernaturally given. In his psychology and pedagogy everything has a natural history. Royce has contributed much in the same direction in his *Outlines of Psychology*, in which he explains initiative, docility, will, and conduct as the resultant of complex impulses which are the outgrowths of inherited and individual experiences that become organized into latent tendencies.

The Present a Reverberation of the Past.—The beginnings of all great types of action have their roots far back in the past, that is, they are instinctive. Even conception, judgment, and reason—which we are apt to regard as the antipodes of instinct—are themselves in part instinctive. The more efficient they are, the greater the instinctive capital with which they start. Royce has said of walking, creeping, etc., that their mastery was "very slowly reached as the result of a training whose details were nowhere predetermined by heredity, while on the other hand, every step of the process was indeed predetermined by hereditary constitution *to tend*, in the normal child, *toward a result that would give it, under the circumstances of its individual life, the powers of locomotion suited to a human being*." [1]

In a similar manner Marshall accounts for religion, duty, and conscience upon a genetic basis. He says: "We here conceive of conscience as the protest of a persistent instinct against a less persistent, but momentarily more powerful one, and we are led to the belief that conscience has been evolved by natural evolutionary forces. We are thus led, therefore, to look upon conscience as being in general the surest guide we have to mark the way in which we should direct our lives if we would act in accord with what we call the law of development." [2]

[1] *Outlines of Psychology*, p. 304.
[2] *Instinct and Reason*, p. 410.

Oliver Wendell Holmes wrote:[1] "But mind this: the more we observe and study, the wider the range of the automatic and instinctive principles in body, mind, and morals, and the narrower the limits of the self-determining conscious movement." Dr. Hall says: "There is one thing in nature, and one alone, fit to inspire all true men and women with more awe and reverence than Kant's starry heavens, and that is the soul and the body of the healthy young child. Heredity has freighted it with all the accumulated results of parental well and ill-doing, and filled it with reverberations from a past more vast than science can explore; and on its right development depends the entire future of civilization two or three decades hence. Simple as childhood seems, there is nothing harder to know; and responsive as it is to every influence about it, nothing is harder to guide. To develop childhood to virtue, power, and due freedom is the supreme end of education, to which everything else must be subordinated as means. Just as to command inanimate nature we must constantly study, love, and obey her, so to control child-nature we must first and perhaps still more piously study, love, obey it. The best of us teachers have far more to learn from children than we can ever hope to teach them; and what we succeed in teaching, at least beyond the merest rudiments, will always be proportionate to the knowledge we have the wit to get from and about them." [2]

Nascent Periods.—The term nascent period is employed in chemistry to designate that state of a compound in which it is just beginning to form. It has already come into use in biological interpretations of education to indicate the time of the budding of instincts. The instinct begins to manifest itself when the organism is mature or ripe in development. Structure and function develop together. Consequently whenever a new instinctive tendency appears it is indicative of the approaching maturity of the correlative structure. Baldwin [3] has called

[1] *Autocrat of the Breakfast Table*, p. 100.
[2] *North American Review*, Feb., 1885, p. 146.
[3] *Mental Development*, chap. 4.

attention to the fact that the instinct for vocal speech begins to manifest itself synchronously with the preferred use of the right hand. Up to the age of eight or nine months the child is ambidextrous. During the same period no attempt has been made to talk. Since they arise at the same time and since the centres controlling the two functions are so closely situated, Baldwin regards the two processes as functionally related and as having the same nascent period. My own experiments with children confirm Baldwin's conclusions.

A study of the prominent human instincts shows that there are nascent periods in the development of each of them. Fear is not displayed at birth, but develops after a few months. Walking is deferred from nine to twenty-four months;[1] curiosity is scarcely worthy the name for some years; the collecting instinct is not noticed in most children for some years; the sex instinct, the parental instinct, the religious instinct, all have their special budding periods. During these periods the golden opportunity for their cultivation is presented.

Nascent Periods in Motor Development.—Mosso wrote: "In man the brain develops later than in all other animals, because his muscles also develop later. The striped muscles are more incomplete at birth in man than in any other animal. For this fact that the human brain develops so slowly, I am able to discover no other reason than this, that at birth the organs which effect movement over which the brain exercises its authority, are not yet complete."

He says further: "If we wish to hasten the maturity of the brain, we must decide whether the formation of the myelin can better be hastened by stimulations of the senses and intellectual work, or better by muscular exercises. The latter way seems to me the more natural. We must, therefore, to begin with, consoli-

[1] One can readily detect the nascent period for walking by supporting the child in such a way as to allow the feet to dangle and not touch the floor. If ready to walk soon, the child's legs will alternate in their motions, if not they will swing synchronously. Many think it is the practice given the child which enables it to learn locomotion. James says some blisters on the feet for a few weeks would demonstrate that the child would walk anyway.

date the motor nerve paths which develop first, and after that seek to develop the portion of the brain concerned with intellectual work. Modern views show a tendency to confirm what the great philosophers of Greece already recognized, viz., that children ought to begin to read and write only with the tenth year. The conviction is again slowly maturing that our children begin to learn too early, that it is injurious for the development of the brain to be fettered to the school-desk when only five or six years old. The conviction is slowly making its way that no more time should be devoted to intellectual work than to muscular exercise. The modern education of youth, however, resembles more an artificial hot-house culture than a natural training of the human plant." [1]

Similarly we may regard the progress of development of all inherent capacities and powers. Even those more indefinite powers, like power of mechanical memory, ability to learn abstract arithmetic and grammar, have their periods of budding vigor when their cultivation can be best effected. The chapters on motor ability and on the development from fundamental to accessory, give ample evidence that the child of five has very little control of the accessory muscles. Manual dexterity requiring fine co-ordinations should not be attempted in childhood. Fine writing and the use of small tools should be deferred until later. The nascent period for the acquisition of manual skill is early youth. The maximum dexterity is not attained then, but the cultivation must then begin if the fullest fruitage is to ensue. Many superintendents are convinced that manual training in its complete forms should be begun not later than the grammar grades. Authorities in colleges of engineering argue for manual training in the secondary schools because those who defer it until the college is reached fail to acquire the same degree of skill. To gain great skill in playing the piano and other musical instruments, it is well understood that it is absolutely necessary to begin in early life.

[1] *Clark University Decennial Celebration Volume,* p. 383.

Nascent Period for Language.—There is a special period in the life of the child when his capacity and interest in acquiring vocalized speech are at their best. The child gives abundant evidence of this period by his constant chatterings and his amazing acquisitions. In a few months he acquires a vocabulary which would take an adult as many years to acquire. This period is at its best from about one and a half years to ten or twelve. During this period the child should be in an environment where, through imitation, he can absorb without difficulty all the knowledge of the mother tongue that he will ever need for practical purposes. An ordinary child of a dozen years of age who has been reared in a refined home where correct language is spoken and who has had ample opportunity to talk will be able without schooling to use his mother tongue with facility, force, and precision.

During the same nascent language period there is a golden opportunity for acquiring the ability to speak foreign languages. There is abundant evidence that ordinary children can, in addition to their native tongue, master two or three foreign languages as spoken languages by the time they are ten years of age. This means that they can understand readily what they hear and can use effectively the language in expressing their ideas orally. We have wholesale illustrations of the fact that childhood is the nascent period for acquiring a spoken language. Foreigners who come to this country in childhood acquire such a mastery of the language in a few months that they cannot be distinguished from the native-born. The parents of the same children, however, seldom acquire the language so as to use it with any great degree of precision or skill. It is not because they do not try, but because the vocal organs and the centres controlling them have passed beyond the nascent period of economical functioning in new ways. Children who have acquired these accomplishments know as much of arithmetic, geography, and of other usual school subjects as do the children who have not acquired the additional languages. The children suffer no impairment of health because of the additional acquisitions.

And in spite of such ample evidence we persist in America in organizing our curricula in such a way as to give practically no opportunity to learn foreign languages until too late. To the objection that there is no time, it should be said that there is abundant time if we only would arrange the curriculum so as to adapt it to the stages of development of the unfolding child. We are uneconomical in forcing things at unseasonable times. The Germans and the French can teach us how to arrange our curriculum so as not to waste so much of the child's time.

"The introduction of athletics affords a striking illustration of the decline of the learning power with the progressing years. When golf first came in it was considered an excellent game for the middle-aged; and you have all watched the middle-aged man play. He was so awkward, he could not do it. Day after day the man of forty, fifty, or even older, would go to the golf field, hoping each time to acquire a sure stroke, but never really acquiring it. The young man learned better, but the good golf players are those who begin as children, twelve and fourteen years of age, and in a few months become as expert and sure as their fathers wished to become, but could not. In bicycling it was the same. Eight lessons were considered the number necessary to teach the intelligent adult to ride a wheel. Three for a child of eight. And an indefinite number of lessons, ending in failure, for a person of seventy. . . . As in every study of biological facts, there is in the study of senescent mental stability the principle of variation to be kept in mind. Men are not alike. The great majority of men lose the power of learning, doubtless some more and some less, we will say, at twenty-five years. Few men after twenty-five are able to learn much. They who cannot, become day-laborers, mechanics, clerks of a mechanical order. Others probably can go on somewhat longer, and obtain higher positions; and there are men who, with extreme variations in endowment, preserve the power of active and original thought far on into life. These of course are the exceptional men, the great men." [1]

[1] Minot, *Age, Growth, and Death*, pp. 243, 246.

Instincts Antecedent to Great Interests.—It is no less true that there are nascent periods for acquiring a knowledge of abstract grammar, abstract arithmetic, philosophy, science, and other subjects. Every great interest presupposes a corresponding innate ability. No one ever developed a great headway of interest in anything for which he did not possess some real capacity. The boy who can without training sprint a hundred yards in eleven seconds is interested in reducing his time to ten seconds; but the clumsy fellow who requires fifteen or more seconds develops no special interest in sprinting—that is, in sprinting himself. He may develop the gambler's interest in seeing others sprint. Many think they are interested in football and other sports, but most of them are merely interested in being amused, not in participating. Only those with innate abilities are so interested. Similarly with music, art, mathematics, or language. The interest which leads people to be patient workers and producers in any of these lines is coupled with inherent capacity in the given direction.

On the extreme importance of recognizing nascent periods in education, Dr. Balliet remarks: "There is a nascent period for each physical and mental power, a period of rapid growth when new aptitudes and interests are developing. It is our dense ignorance of most of these nascent periods that makes it impossible for us as yet to prepare a proper course of study. Hence our courses of study are little more than conscientious guesses. When we shall know more about these nascent periods, we shall be able to arrange a course in which the various phases of every study will be presented at the proper period when they will appeal most strongly to the child. Such a course of study must take into account three types of children . . . the observer, the thinker, and the doer. The last type has but recently been recognized in education."

Many Instincts Transitory.—It has only recently become understood that instincts are not functional in a fixed manner all through life. Most people, for example, think that wildness, methods of food-getting, etc., are given once for all

and are in no way affected by individual experience, *i. e.*, education. But two important laws should be remembered in this connection: (1) Many instincts develop at a certain age and then disappear; (2) Many instincts, if unexercised or unaided by environment, fail entirely to develop, or remain stunted and dwarfed.

Every one knows that playfulness is a characteristic of the young rather than of the adult. That the adult does not play is not a matter of environment or circumstances, but a result of the fading of the instinctive impulse to play. Tadpoles breathe by means of gills instead of lungs; the frog naturally adopts a new mode of existence in response to new instincts and in consequence of the passing of old ones. The young calf instinctively follows, but in time the tendency fades. The young child at first instinctively gets food by sucking, but later the impulse fades and is replaced by a no less instinctive tendency to bite and chew. Allusion was earlier made to the instinctive function of swimming movements, and the transient power of infants to hang by their hands. In fact, numberless rudimentary instincts, like vestigial organs, come into function, survive a brief time, and then either partially or completely atrophy. In a sense all the organs and functions of infancy are rudimentary. They subserve a purpose for a given stage and then give way to a higher form.

Atrophy of Unexercised Instincts.—Spalding, the renowned observer of animal habits, tells of a friend of his who "reared a gosling in the kitchen, away from all water. When this bird was some months old, and was taken to a pond, it not only refused to go into the water, but when thrown in scrambled out again, as a hen would have done. Here was an instinct entirely suppressed." [1] All dogs have an instinct to bury bones, old shoes, gloves, and other articles. It was doubtless necessary for their ancestors to bury food for self-preservation. James remarks [2] that dogs brought up for the first few weeks of life on a

[1] Lewes, *Problems of Life and Mind*, vol. I, p. 22, note.
[2] *Principles of Psychology*, vol. II, p. 399.

hard floor where there is no possibility of really burying anything, will nevertheless obey the promptings of instinct and will make an attempt to bury sundry articles. The futile attempts are, however, abandoned after a time and are not repeated all through life. The lack of exercise of the instinct was the cause of its atrophy. Spalding and James both record that calves and chicks, which always manifest the instinct to follow the mother, lose this impulse in a few days if put under different environment which develops other habits.

Arrested Development.—I have often had occasion to teach algebra to mature persons who had never studied the subject previously. I have also taught the subject to boys and girls of a dozen years and have found that the latter grasp the subject much more easily and better than the former. The minds of the adults had become so habituated to thinking the elementary processes that a transition to higher processes was rendered difficult. While we should fix, in the form of habits, all activities that must be continually repeated in the same way, yet we should guard against too definite crystallization of thought processes. Every habit tends to enslave its possessor. Pupils and parents are continually making a mistake in requesting that the children be allowed to "go over subjects again so as to get them thoroughly." If it is found inadvisable because of immaturity to promote children who have made a reasonable passing grade, it would be far better to have them take new matter of an elementary nature rather than to review all the old material in exactly the same fashion. A pupil should never be kept back in all his studies because of failure in a part of them.

Arrest occurs (*a*) through the premature or excessive exercise of a function or (*b*) through lack of exercise during the nascent stage. Not only do physical and intellectual arrests occur, but also emotional, volitional, and moral arrest may as easily ensue through the same causes. Darwin tells us with great sadness in his later years of his utter inability to appreciate music and æsthetic effects in general. He attributed the lack to atrophy,

due to disuse. His extreme devotion to an intellectual ideal had left no room for æsthetic culture. It is a pity that the beautiful in nature and art has not been considered of as great importance as the crassly utilitarian. A survey of our almost parkless cities, undecorated or fussy architecture, the lack of beautiful paintings, the ugly house interiors, the bleak farms without trees, flowers, or artificial adornment, all attest that we are pursuing methods which tend to stifle all æsthetic impulse. The lack of adornment and beautification in life, however, is certainly not because of total degeneracy in æsthetic life. The fact that even the working people will select the best music and the best art when free to them is evidence enough of æsthetic instincts which struggle for assertion.

The will may suffer arrest in a great variety of directions. The child who is always pampered and never required to exercise deliberation or put forth effort, grows up with undisciplined powers. When the power of control would make him a conqueror he finds himself the slave of appetite and passion, and the victim of chance environment. Every drunkard despises himself in his sane moments and yearns for the nobility of self-control, but the flabby will cannot withstand the tempter's voice. Habits of virtue and righteousness have never been established and all the wishes and yearnings he can muster are overpowered by the habits of vacillation or of absolute unrighteousness.

In the case of undesirable instincts it is well to know when and how to arrest development. Royce has very aptly said that "childhood is a great region of life for the sprouting and first springing of the young weeds of future mental disorder. The full-grown maladies of the asylums need older brains to live in; but child psychology is often full of elements from which future troubles may come. It therefore behooves the teacher of young children to be, if possible, psychologist enough to know, and by sight too, those symptoms of instability of brain which are so common in early years." [1]

[1] "Mental Defect and Disorder," *Ed. Rev.*, 15: 322.

Hall wrote that systematic gymnastic exercises applied at the right time may produce immediate and often surprising development of lung capacity. The same attempts with boys of twelve utterly fail because the nascent period has not yet come. Donaldson demonstrated that forcing open the eyelid of a young kitten prematurely and stimulating with light arrested the development of medullation.[1] He also wrote of arrested development in another connection, saying: "Development and the changes involved in growing old, are by no means synonymous, so that although in those animals with a fixed size there are always to be found undeveloped cells, yet it is not a correct inference that these cells are also young in the sense that they might still complete their development. It appears, rather, that the capacity for undergoing expansive change is transient, and that those cells which fail to react during the proper growing period of an animal have lost their opportunity forever."[2]

Mistaken notions concerning the teaching of arithmetic and grammar have doubtless been responsible for a multitude of pedagogical sins. The formalist regards the course of study as a pedagogical grindstone upon which the wits of the child are to be sharpened. We remember in this connection Robert Recorde's arithmetic book called *The Whetstone of Witte.* Mathematics is said to develop the reasoning powers and many have believed that the earlier it could be introduced the greater would be the development. Little children have been forced to take it in allopathic doses in the hope of prying up their reasoning powers. Abstractions in grammar have been likewise forced upon them. Not only have the children failed to comprehend the abstractions, but their reasoning powers have been stunted and dwarfed rather than developed. The forcing process caused arrest of development.

Dr. Harris, former Commissioner of Education, was the first to call attention in a striking way to the subject of arrested development in education caused through overtraining. He remarked that the attempt of many teachers, in their very

[1] Hall, *Adolescence,* vol. I, p. 207. [2] *Growth of the Brain,* p. 37.

zeal for good teaching, "to secure what is called thoroughness in the branches taught in the elementary schools, is often carried too far; in fact, to such an extent as to produce arrested development (a sort of mental paralysis) in the mechanical and formal stages of growth. The mind in that case loses its appetite for higher methods and wider generalizations. The law of apperception, we are told, proves that the temporary methods of solving problems should not be so thoroughly mastered as to be used involuntarily, or as a matter of unconscious habit, for the reason that a higher and more adequate method will then be found difficult to acquire. The more thoroughly a method is learned the more it becomes a part of the mind, and the greater the repugnance of the mind toward a new method. For this reason parents and teachers discourage young children from the practice of counting on the fingers, believing that it will cause much trouble later to root out this vicious habit and replace it by purely mental processes. Teachers should be careful, especially with precocious children, not to continue too long in the use of a process that is becoming mechanical; for it is already growing into a second nature, and becoming a part of the unconscious apperceptive process by which the mind reacts against the environment, recognizes its presence, and explains it to itself. The child that has been overtrained in arithmetic reacts apperceptively against his environment chiefly by noticing its numerical relations—he counts and adds; his other apperceptive reactions being feeble he neglects qualities and causal relations."[1] It is more important that the child should learn to curb his temper, control his fists and tongue when under provocation, bear defeat and pain heroically, move his muscles economically and gracefully, stand surprises without shock, abstain from strong drink, tobacco, and vicious habits, than to know the multiplication table or grammar. The Scriptures even go so far as to assert that "He that ruleth his spirit is greater than he that taketh a city." But positive control is a much higher control than

[1] Harris, W. T., "The Study of Arrested Development in Children as Produced by Injudicious Methods," *Education*, 20: 453–456.

negative. The child who goes into tantrums, pampers his appetites, shirks his lessons, escapes all physical labor, has his will hopelessly arrested. Habits of righteous volition must be ingrained early or the man is doomed to go through life a nerveless sentimentalist. No one ever develops athletic prowess after maturity, nor is it much more possible to develop positive moral virtues unless the foundations have been laid in childhood and youth.

Arrest of religious development may occur through precocity induced by too early memoriter learning of dogmatic forms and formulas. The acquisition of any proverb or formula not understood may bias wrongly one's whole course of life. We all know how the unfortunate knowledge of the superstitions concerning the number 13, Friday, charms, omens, and amulets torments us and even causes us to act upon them although against our best judgment. Similarly antiquated medical advice which we learned when young, and which is sometimes absolutely pernicious, is so hard to abandon that we heed it even at our peril. In the same way dogmas and formulas which really possess symbolical or metaphorical meaning are accepted literally and in their distorted misinterpretation become permanent mental possessions. Our minds become so indurated with these modes of functioning that higher and truer development becomes impossible. The child's mind perceives things literally and in the concrete, but abstractions in science and morals, which are mumbled and misinterpreted, become a menace to higher growth. On the other hand, to fail to give the child the concrete foundations in science, conduct, or religion means that subsequent comprehension of abstractions is forever precluded. Many a man who might have become a scientist by learning early the concrete facts out of which higher concepts could be evolved, has never glimpsed scientific realms because his early experiences have contributed no background of apperceiving masses. Likewise in morals and religion, lack of concrete personal experiences out of which diviner conceptions could evolve has doomed many to dwarfed moral and religious development.

Summary and Conclusions.—The study of instinct reveals very clearly that mankind is not a finished product but that the race is ever in the making. There is ceaseless change. There can be no standstill. The change may be either upward or downward, progressive or degenerative. The same forces which produce fuller, more abundant racial life, if perverted, may cause degradation and extinction. The effects of life experiences—education—do not cease with the individual. All posterity shares in the heritage received by the individual and modified by his life. The life experiences of one generation become the impulses of the next and all future ones.

Education is thus magnified in importance. The full realization of its meaning should lead from selfishness to the highest altruism. It is the business of education to select and create for perpetuity those instincts which will contribute to the development of the highest ideals of life. Harmful instincts should be allowed to atrophy through disuse or to be shunted off into useful channels. For example, many tendencies toward vice, immorality, and crime should be allowed to decay by accentuating good impulses. In some cases they must even be considered as diseases and therefore combated. All organic diseases, mental defects, and moral degeneracy should be eliminated. Purposive selection should be employed to aid chance natural selection. Purposive selection should even correct natural tendencies, for heredity preserves defects as well as excellencies. In many cases the continuation of characters represents no selective process. Heredity simply continues what has been acquired in previous generations. For example, ugliness is never perpetuated through selection, but heredity nevertheless causes it to persist through generation after generation of the same family.

One great problem of education is to so understand instinct as to correlate the individual with his environment and secure the fullest and richest measure of life. Each individual should be more highly developed than his ancestors and should have fewer undesirable tendencies. Getting rid of original sin means

eliminating some harmful hereditary traits, abridging others, and shunting others.

Pessimists often raise the cry that no race progress is discernible. They argue that the world is no better to-day than four thousand years ago, that no one possesses a higher grade of intellect than in the earliest historic times. There is no warrant for such pessimism. There were giant intellects in the palmy days of Greece and Rome, and in the time of the Pharaohs, but the world average then was vastly lower than now. It may even be seriously doubted whether the giants of old would be so conspicuous were they alive to-day. The high level of to-day might make them sink out of sight by comparison. To-day there are thousands planning and executing enterprises as gigantic as the erection of the pyramids or the generalship of the Peloponnesian War. In every civilized country there are many writers, statesmen, kings of finance, inventors, scholars, educators, who have accomplished as great things as are recorded in the annals of ancient Rome, Greece, Egypt, or Palestine. They may never be singled out because the same degree of intelligence is so common.

That new instincts, physical, intellectual, and moral, have been developed, and are being developed, there can be no doubt. That some impulses have become atrophied and are dying out there is equally little doubt. The uniform attainments in poetry, music, scholarship, statesmanship, and commerce are greater than ever before, and it is reasonable to suppose that there is a close relationship between attainments and ability. Many troublesome instincts like pugnacity, selfishness, and sensuality are becoming subdued and controlled. The higher instincts of reason, morality, conscience, altruism, and religion have become expanded and strengthened. We now have less of war, carnage, gluttony, and lust, and more of refined courage, altruism, and love, than ever before in the world's history. The deeds of men as recorded in the annals of history, sacred and profane, make a splendid record of the growth of the higher and nobler powers and the crushing to heel of the baser instincts. The very fact

of the conservation of energy teaches that forces may become cumulative and tendencies or impulses to action be created. The facts of memory, habit, and heredity lead to the same inevitable conclusion. If we believe in evolution and the development of civilized man from primitive savagery, we cannot escape it; for is not the greatest difference between savagery and civilization one of instincts?

When we remember that interests are determined largely by instincts, it is at once seen that a knowledge of instinct is of great importance in determining courses of study. In the light of a knowledge of instinct the course of study is adapted to the capacities of individuals. The school is fitted to the child rather than the child to the school. The intelligent administration of the entire elective system must be thoroughly grounded upon a knowledge of the fundamental instinctive powers of the individual. There have been altogether too many misfits in the world because of a lack of recognition of innate possibilities and needs. Education is not only to minister to thoroughly apparent needs and interests of the individual, but one of its most important functions is to discover interests and aptitudes.

A better knowledge of nascent periods of development would effect many readjustments in the position of different subjects and topics in the curriculum. Already the fruits of even our limited knowledge of the subject are becoming apparent. The kindergarten work has been remodelled, formal arithmetic work is disappearing from the primary grades, concrete work is finding its place in the elementary schools, elementary algebra and concrete geometry have been shifted from the high school to the grammar school, and the abstract arithmetic has been relegated to the high school. Formal grammar is less emphasized in elementary work, and ought to be pushed still higher up. It is being recognized in practice that modern foreign languages can be most advantageously begun between seven and twelve. There are well-marked stages in the growth of interest and power in drawing which should serve as a guide in arranging drawing courses. Already the ultra-logical course in drawing has been

replaced by a more rational psychological arrangement recognizing the well-marked stages of development. The organization of manual training departments and schools is in part a tacit recognition on the part of educators [1] that the instincts for motor activity and of constructiveness are the most valuable allies in the training of childhood and youth, and must be utilized if education is to be normal and balanced. The head, the hand, and the heart, metaphorically speaking, all have claims asserting themselves which must be recognized if we would avoid malformation. As a final illustration, we may cite the recent recognition of the peculiar period of adolescence. The main value of the recent study of adolescence has been in the appreciation that there is a special time of budding of the most powerful instincts of the human race. The proper adjustment of the curriculum and the better recognition of nascent periods of development would guard against arrest of development, and enable educators to co-operate with nature in developing children normally from one stage to another and into the fullest and noblest manhood and womanhood made possible through the heritage bequeathed to each.

[1] The people see in them doubtless only utilitarian ends and support them on that account.

CHAPTER IX

NATURE AND NURTURE: INHERITANCE AND EDUCATION

Meaning and Illustrations of Heredity.—It is a law of nature that the descendants of individuals tend to be like their ancestors. Every one knows that children are apt to look like their parents or near relatives, to have similar dispositions, and to have many characteristics common to the family group. This law of transmission and reproduction of ancestral traits in descendants is termed heredity. President David Starr Jordan says:[1] "There is something inherent in each developing animal that gives it an identity of its own. Although in its young stages it may be indistinguishable from some other kind of animal in similar stages, it is sure to come out, when fully developed, an individual of the same kind as its parents were or are. The young fish and the young salamander are indistinguishably alike, but one embryo is sure to develop into a fish and the other into a salamander. This certainty of an embryo to become an individual of a certain kind is called the law of heredity." This is the great conservative force in nature. Through heredity evolution is also made possible, since variations once established tend to be transmitted to posterity.

Heredity of Physical Structure.—Heredity of physical structure is everywhere apparent among human beings. It may manifest itself in stature, weight, length of limbs, color of eyes or hair, facial features, expression, etc. Children are often said to be exact images of father, mother, or grandparents. Among animals resemblances of young to parents are equally striking. The same laws are observable in plants. It may be safely pre-

[1] *Animal Life*, p. 88.

dicted that a grain of corn or any other plant seed will produce under ordinary conditions a new plant of the same kind and of similar size, form, and color as that which bore the seed. These facts are all too obvious to need more than suggestion. Internal structures as well as external are governed by the laws of heredity. The various proportions of the cranium, thorax, vertebræ, teeth, the peculiarities of the circulatory system and the nervous system, which are manifest in a given individual will probably be found upon investigation to be characteristics common to his ancestry and his posterity. Ribot tells us that "There are some families in which the heart and the principal blood-vessels are naturally very large; others in which they are comparatively small; and others, again, which present identical faults of conformation." The nervous system, especially the brain, seems to follow a certain type in a given family or "line of ascent." Length of natural life is doubtless an ancestral bequest. In a family where there is a centenarian there is almost sure to be a large number who live to a very old age, exceeding their allotted "three score years and ten." Ribot writes that, "longevity depends far less on race, climate, profession, mode of life or food, than on hereditary transmission." [1]

Thomson says that "not less striking than the long persistence of specific and stock characters is the fact that offspring frequently reproduce the *individual* peculiarities—both normal and abnormal—of their parents or ancestors. A slight structural peculiarity, such as a lock of white hair or an extra digit, may persist for several generations. A slight functional peculiarity, such as left-handedness, has been recorded for at least four generations, and color-blindness for five." [2]

Hereditary Disease Tendencies.—While specific diseases as such are probably not directly heritable, it is none the less true that tendencies to disease are very definitely inherited. A disease, according to Martius, is a *process* injurious to the organism. "The process," says Thomson,[3] "is not transmitted, but

[1] Ribot, *Heredity*, pp. 3 and 5.
[2] J. Arthur Thomson, *Heredity*, p. 70.
[3] *Op. cit.*, p. 265.

the potentiality of it is involved in some peculiarity in the organization of the germ plasm." The same authority writes that: "There are endless illustrations of the fact that a pathological diathesis—rheumatic, gouty, neurotic, or the like—may persist and express itself similarly, even in spite of altered conditions of life, throughout many generations." [1] While microbic diseases are not directly heritable, it should not be supposed for a moment that children of parents afflicted with such diseases as tuberculosis are no more liable to it than are children of parents entirely free from it. In a strict biological sense the disease is not transmitted, but the devitalized constitution giving a predisposition is heritable. Karl Pearson has recently made statistical studies on the subject,[2] and Woods asserts that he "has found cogent proof in the first of these studies that the phthisical diathesis is just as hereditary as any human characteristic we know about." [3] Thomson remarks that "the fact that tubercular disease may be a shadow over a family history for generations is doubtless mainly due to an inheritance of what began as a truly germinal or blastogenic variation, which is only a biological way of expressing what the physician means by a 'particular predisposition,' 'a tubercular temperament,' 'a diathesis' and so on." [4]

Good and poor eyesight are family characteristics. Congenital blindness sometimes occurs in several generations of the same family. In one family thirty-seven children and grandchildren became blind between their seventeenth and eighteenth years. Of another family, a father and his four children all became blind at the age of twenty-one.[5] "Color-blindness," says Ribot, "is notoriously hereditary. The distinguished English chemist, Dalton, was so affected, as were also two of his brothers. Sedgwick discovered that color-blindness occurs oftener in men

[1] *Op. cit.*, p. 70.

[2] Pearson, *A First Study of the Statistics of Pulmonary Tuberculosis:* Dulau and Co., London, 1907.

[3] Woods, *The American Naturalist*, 42: 691.

[4] *Op. cit.*, p. 284.

[5] Sedgwick, *British and Foreign Medical and Chirurgical Review*, 1861.

than in women." Darwin wrote:[1] "Myopia is said to be becoming hereditary among certain civilized nations, especially the Germans." Particular types of hearing are doubtless hereditary. Although the offspring of a deaf-mute and a person of sound hearing are seldom deaf, yet where both parents are mute their children are apt to be deaf or to be afflicted with some kindred disease. In the Deaf and Dumb Institution in London: "Among 148 pupils in the institution at one time, there was one in whose family were 5 deaf-mutes; another in whose family there were 4. In the families of 11 of the pupils there were 3 each; and in the families of 19, 2 each."[2] The brothers and sisters of the deaf are deaf in 245 cases in 1,000. The child of deaf parents is 259 times as likely to be deaf as if its parents were normal.[3] "Out of 901 admissions to an asylum, 477 had insane relatives; out of 321 cases of epilepsy, 105 had a family taint (about 35 per cent.); out of 208 cases of hysteria, 165 had a family taint (about 80 per cent.). Various specialists on mental disorders have found reason to believe in hereditary transmission in from 25 to 85 per cent. of their patients, the diversity being doubtless in part due to the great variety of nervous diseases."[4]

Again, because a specific disease afflicting a parent does not reappear in the children the belief in heredity is often weakened. But it is becoming understood that the specific defects are not necessarily those of the ancestors, but rather the result of weakened or abnormal vitality. There are many diseases which seem to be closely related because they arise under similar conditions of weakened vitality, *e. g.*, tuberculosis, scrofula, and many glandular and skin diseases. The specific disease may be pulmonary consumption, scrofulous tumor, or cancer. There is a whole train of afflictions akin to deaf-mutism. Congenital deaf-mutes are usually defective in mind and body. Ordinary deaf-mutism is closely allied to idiocy, and is one of the hereditary neuroses. "In the family of the deaf-mute, inquiry will

[1] *Variation of Plants*, II, p. 70. See also August Cohn, *Hygiene des Auges.*

[2] Ribot, *Heredity*, p. 42.

[3] E. A. Fay, *Marriage of the Deaf in America*, p. 49.

[4] Thomson, *Heredity*, p. 294.

frequently discover idiotic, epileptic, blind, or scrofulous brothers and sisters; dipsomania, insanity, epilepsy, phthisis, or imbecility in the parents or earlier ancestors, and like conditions in collateral branches of the family. . . . Occasionally a whole family is found deaf and dumb." [1] Insanity is almost inseparably connected with neurotic degeneracy and according to Sachs,[2] "Heredity is the potent factor in the causation of juvenile and adult insanity." Thomson says that a specific nervous predisposition may be heritable but in most cases it is "a general predisposition to some dislocation or derangement of the nervous system." Clouston says: "A neurotic heredity is seen to resolve itself into general morbid tendencies rather than direct proclivities to special diseases." [3]

Thus we see that specific diseases are usually the manifestation of general constitutional degeneracy. This is especially true of diseases of the nervous system. Any disease affecting this system is indicative of neurotic conditions. The particular disease may vary with succeeding generations. In one it may be a sensory defect; in another, epilepsy; in another, tendency toward bad habits; in another, malformation, especially of the head and facial features; in another, speech defects; in another, hypersensitivity. So long as the predispositions exist the disease may in a certain sense be termed hereditary. Like any memory, its identity may be lost in the complex of forces, but it just as truly helps to determine the final resultant.

Life-insurance companies place the utmost confidence in heredity. They make the most searching inquiries concerning the health of ancestors and relatives. Many a person is rejected solely on grounds of hereditary taints, even though he may be apparently a perfect risk. Insanity and suicidal tendencies are regarded with extreme suspicion. Diseases frequently, and degeneracy always, have a family history. In discussing the question frequently only the immediate parents are considered, when

[1] S. A. K. Strahan, *Marriage and Disease*, p. 163.
[2] *Nervous Diseases of Children*, p. 610.
[3] Thomson, *op. cit.*, pp. 280, 281, 294.

the whole complex of ancestral bequests must be taken into account.

Heredity of Mental Characteristics: General.—Darwin wrote: "The tenacity of instincts is so great and their hereditary transmission so certain, that sometimes they are found to outlive for centuries the conditions of life to which they are adapted." "We have reason to believe,' says Ribot, "that aboriginal habits are long retained under domestication. Thus with the common ass we see signs of its original desert life in its strong dislike to cross the smallest stream of water, and in its pleasure in rolling in the dust. The same dislike to cross a stream is common to the camel, which has been domesticated from a very early period." [1]

Of the great conserving power of memory, Ribot writes: "We daily experience thousands of perceptions, but none of these, however vague and insignificant, can perish utterly. After thirty years some effort—some chance occurrence, some malady—may bring them back; it may even be without recognition. Every experience we have had lies dormant within us: the human soul is like a deep and sombre lake, of which light reveals only the surface; beneath, there lives a whole world of animals and plants, which a storm or an earthquake may suddenly bring to light before the astonished consciousness.

"Both theory and fact, then, agree in showing that in the moral, no less than in the physical world, nothing is lost. An impression made on the nervous system, occasions a permanent change in the cerebral structure, and produces a like effect in the mind—whatever may be understood by that term. A nervous impression is no momentary phenomenon that appears and disappears, but rather a fact which leaves behind it a lasting result—something added to previous experience and attaching to it ever afterward. Not, however, that the perception exists continuously in the consciousness; but it does continue to exist in the mind in such a manner that it may be recalled to the consciousness." [2]

[1] Ribot, *Heredity*, p. 16.

[2] Ribot, *Heredity*, p. 48.

Mosso writes: "Destiny leads each one of us with a fatal inheritance. Though we were abandoned in a forest, imprisoned in the dungeon of a tower, without a guide, without example, without light, there would yet awake in us like a mysterious dream, the experience of our parents and our earliest ancestors. What we call instinct is the voice of past generations reverberating like a distant echo in the cells of the nervous system. We feel the breath, the advice, the experience of all men, from those who lived on acorns and struggled with the wild beasts, dying naked in the forest, down to the virtue and toil of our father, to the fear and love of our mother." [1]

We are somewhat surprised to find that heredity of mental traits has been recognized only a short time. Sir Francis Galton said [2] in 1865: "The human mind was popularly thought to act independently of natural laws, and to be capable of almost any achievement, if compelled to exert itself by a will that had a power of initiation. Even those who had more philosophical habits of thought were far from looking upon the mental faculties of each individual as being limited with as much strictness as those of his body, still less was the idea of the hereditary transmission of ability clearly apprehended." Still we must remember that the doctrine of innate ideas as held by the Middle-Age philosophers held sway until a very recent time. In fact, it is a half belief of the popular mind still.

Heredity of Memory.—Ribot makes an interesting and exhaustive study of the heredity of various psychological powers, including memory, imagination, the will, instinct, the sentiments and passions. He shows that memory is indeed merely a disposition of nervous tissue on the one hand and of the mind on the other to act again in a way in which they once have acted. Memory is a dynamic relation existing among various elements. It is habit in the making. Consequently there are various types of dynamic possibilities. A given type, he believes, is apt to be characteristic of the various members of a family. He mentions

[1] *Fear*, p. 63.

[2] *Hereditary Genius*, Preface.

several cases to support his view: "The two Senecas were famed for their memory: Marcus Annæus could repeat two thousand words in the order in which he heard them; the son, Lucius Annæus, was also, though less highly, gifted in this respect. According to Galton, in the family of Richard Porson, one of the Englishmen most distinguished as a Greek scholar, this faculty was so extraordinary as to become proverbial—the Porson memory." [1]

Hereditary Imagination.—Families are often renowned for their special types of imagination. Among painters it is not at all uncommon to find several generations of especially gifted artists. In the family of Titian were nine painters of great merit. Cagliari had several relatives who were nearly as illustrious as himself. A catalogue of names of painters who have belonged to families celebrated for their artistic genius must contain such names as Rafael, Van Dyck, Murillo, and Claude Lorrain. Ribot says: "A glance at any history of painting, or a visit to a few museums, will show that families of painters are not rare. In England you have the Landseers; in France the Bonheurs. Every one has heard of the Bellinis, Caraccios, Téniers, Van Ostades, Miéris, Van der Veldes. In a list of forty-two painters—Italian, Spanish, and Flemish—held to be of the highest rank, Galton found twenty-one that had illustrious relatives." [2]

Another type of imagination which can be easily studied for hereditary tendencies is the musical type. Sebastian Bach was the greatest of an extraordinarily gifted family of musicians. The family began in 1550, and was illustrious through at least eight generations. Beginning with Weit Bach, the Presburg baker, we have a record of an "unbroken line of musicians of the same name that for nearly two centuries overran Thuringia, Saxony, and Franconia." In the family there were twenty-nine eminent musicians. The names of Beethoven, Mendelssohn, Mozart, and Haydn all represent families famed for their musical abilities.

[1] *Heredity*, p. 53. [2] *Heredity*, p. 60.

Science, Literature, Generalship.—Galton has shown us that it is not rare to find many members of the same family eminent in science. Among those who have come from families of intellectual distinction may be instanced Plato, Aristotle, Francis Bacon, Cuvier, Darwin, Franklin, Galileo, Herschel, Humboldt, Leibnitz, Mill, Pliny, Stephenson, and Watt. Among well-known family names in literature the following are splendid examples: Addison, Arnold, Brontë, Grotius, Helvetius, Lessing, Macaulay, Schlegel, Seneca, de Staël, Swift, and Stowe. Galton shows that the great commanders in history have all belonged to families which had many individuals eminent in some direction or other. From among the most striking examples the following may be selected: Alexander, Philip, the Ptolemies, Bonaparte, Cæsar, Charlemagne, Cromwell, Gustavus Adolphus, Hannibal, Wellington, and he might have added Washington. I should not argue that particular callings are determined by heredity. That is largely a matter of imitation or chance. But the high-grade intellectual ability necessary to these callings is determined by heredity.

Families of Statesmen.—In studying statesmen as a class to determine whether the qualities that make statesmen are hereditary, Galton believes that there are abundant facts to prove it. He mentions the names of many illustrious statesmen who have belonged to families in which many members have achieved deservedly high reputations. Among these are: Pitt, Erskine, Marlborough, Brougham, Walpole, Romilly, Palmerston, Grenville, Fox, Wilberforce, Cromwell, Adams, Mirabeau, and Richelieu. He says: "The statesman's type of ability is largely transmitted or inherited. It would be tedious to count the instances in favor. . . . The combination of high intellectual gifts, tact in dealing with men, power of expression in debate, and ability to endure exceeding hard work, is hereditary." [1]

Families of Jurists.—Galton's study of eminent English judges included so large a number of fathers, sons, grandfathers, and grandsons in the list that he is positive in his con-

[1] *Hereditary Genius*, p. 103.

clusions that judicial qualities are special and transmitted from generation to generation. He says that:[1] "Out of the two hundred and eighty-six judges, more than *one in every nine* of them have been either father, son or brother to another judge, and the other high legal relationships have been more numerous. There cannot, then, remain a doubt but that the peculiar type of ability that is necessary to a judge is often transmitted by descent."

Reasons for Exceptions.—Many great men and women have not had illustrious children; in fact, a very large number have remained unmarried, choosing rather between family life and a great work of which the world seemed to stand in need. Again, many have married companions inferior in capacity and have had children resembling the other parent. Then, again, through a lawful trick which heredity frequently plays, the children resemble much more remote ancestry than their immediate parents. Hence it is not to be wondered at that an illustrious father does not always have children who come to distinction.

History of the Juke Family.—In 1877, R. Dugdale published in the thirtieth annual report of the New York prison commission, a study of the so-called Juke family. Juke is a name given to a large family of degenerates. It is not the real name of the family, but a general term applied to forty-two different families whose ancestry could be traced to one particular man. The father of the Juke family, Dugdale termed Max. He was of Dutch stock, born about 1720. He was shiftless, played truant, and was a general vagabond. He married a woman as worthless as himself. They reared a family of vagabonds and these children in due time intermarried with other vagabonds. By 1877, in five generations, there were 540 direct descendants and about 700 of more distant relation: 310 of the 1,200 were professional paupers, 7 were murderers, 60 were habitual thieves, 130 were criminals who were frequently convicted of crime, 300 died in infancy, while 400 more were physically degenerate. Only 20 of the 1,200 learned a trade and 10 of those learned it

[1] *Op. cit.*, p. 62.

in a state prison. They had cost the State of New York $1,000 apiece, including all men, women, and children; a total of $1,250,000.

History of Jonathan Edwards's Family.—In 1898, Dr. A. E. Whiship, who had made a study of the Jukes, determined to make a study of some desirable family to offset the appalling record of the Jukes. He selected for his study Jonathan Edwards, who was born October 5, 1703. While Max Juke was the founder of a family of 1,200, mostly paupers and criminals, he found that Jonathan Edwards was the founder of a family of 1,400 of the world's noblemen, most of whom have left the world better for having lived in it. It is possible here to cite only a few of the illustrious descendants of Jonathan Edwards. In Yale alone there have been more than 120 graduates who were direct descendants; among these are nearly 20 Dwights, as many by the name of Edwards, 7 Woolseys, 8 Porters, 5 Johnsons, and several of most of the following names: Chapin, Winthrop, Shoemaker, Hoadley, Lewis, Mather, Reeve, Rowland, Carmalt, Devereaux, Weston, Heermance, Whitney, Blake, Collier, Scarborough, Yardley, Gilman, Raymond, Wood, Morgan, Bacon, Ward, Foote, Cornelius, Shepard, Bristow, Wickerham, Doubleday, Van Valkenberg, Robbins, Tyler, Miller, Lyman, Pierpont. Mr. Churchill, author of *Richard Carvel*, is a recent graduate. In Amherst there were at one time of this family, President Gates and Professors Mather, Tyler, and Todd. There is not a leading college in the country in which their names are not to be found recorded. They have not only furnished thirteen college presidents and one hundred or more professors, but they have founded many important academies and seminaries in New Haven and Brooklyn, all through the New England States, and in the Middle, Western, and Southern States. Not only have they furnished scholars, but statesmen, lawyers, financiers, and other men and women of high rank in practically every walk of life. One hundred and thirty-five books of merit have been written by the family, eighteen journals and periodicals of large importance have been

edited by them, and several of them founded by members of the family. Several descendants have been among the most illustrious men of their time. Examples of these are, President Timothy Dwight, President Theodore Dwight Woolsey, Dr. Theodore W. Dwight, President of Columbia College Law School, and Daniel Coit Gilman. The only notable black sheep in the flock was Aaron Burr, Edwards's grandson, and there is no question that he possessed great mental acumen. But for a single unfortunate characteristic and the custom of the time, which allowed this trait to go unchecked, Burr might have been one of the great instead of being numbered among the dishonored. At forty-nine he was one of the most brilliant, most admired, and most beloved men in the United States. For thirty years his career had few American parallels.[1]

Environment Insufficient Explanation.—Perhaps some one may contend that the foregoing shows the result of environment rather than hereditary tendencies. The rejoinder should be made that the environment in a large way was practically the same for the Juke family as for the Edwards. The periods are synchronous and there was no great difference between New York and Massachusetts. It could have been no chance of environment which made nearly all of one family differ from all of the other. If environment were really so potent as many claim, the sameness of environment should have brought the two families as a whole to the same level.

It is not here argued that environment has no effect in determining the ultimate development of individuals. The effects are very consequential. One who disbelieved in them should not remain in the ranks of educators. But there are very definite limits beyond which the effects of environment exercise no control. No amount of feeding could make a mastiff of a poodle. No amount of underfeeding could limit the growth of the mastiff to the size of the poodle. Similarly no amount

[1] See *Jukes-Edwards: A Study in Education and Heredity.* Consult alsc, Fisher, *Report on National Vitality*, 1909, p. 53; Woods, F. A., *Mental and Moral Heredity*, 1909; "*The Jukes,*" *A Study in Crime, Pauperism, Disease and Heredity*, 1877.

of training could make a Shakespeare of an idiot. Shakespeare even though untrained would have been a marked man. We must keep in mind a distinction between great mental power and reputation; between ability and success. Obscurity is not a necessary correlate of weakness. Many intellectual giants have been obscure. A distinction must also be made between biological and social heredity; between intellectual power and the use to which one puts this power. Biological heredity determines largely what mental capacity shall be, but social heredity and environment determine largely what use shall be made of physical and intellectual powers. Morality is much more influenced by environment than is intellectual strength. Whether one makes locks or picks them is much influenced by one's environment, but the capacity to do either is a matter of native endowment.

General Mental Endowments.—Although "strength of mind" is a rather general quality, yet it is perhaps a better basis on which to judge of hereditary tendencies than a more specific phase of mentality like memory, imagination, or will. It is still better than a special intellectual power, like power in mathematics or literature. As is the case with instinct, powers are very plastic and may be applied in a variety of directions. Hence a study of the genealogy of great men, regardless of the particular direction in which power was expressed, ought to be considered good evidence. The avenue of expression is doubtless to a considerable degree determined by environing circumstances. To the possible objection that greatness itself might be determined by environment the rejoinder should be made that while environment may and doubtless does prevent many cases of greatness from ever developing, yet environment alone never produced a genius. In fact, it may be doubted whether environment does much for the genius and the really great except to provide fortunate encouragement at an opportune time. Something more than mere schooling or the acquisition of inherited social forces of civilization is necessary to give one genius or greatness. That something must be an inherited

potentiality which gives one marked individuality, and for which neither the individual nor his environment is responsible or praiseworthy.

After many years of investigation, Pearson in his "Huxley Lecture" for 1903, "On the Inheritance of the Mental and Moral Characters in Man, and its Comparison with the Inheritance of the Physical Characters," stated that "the degree of resemblance of the physical and mental characters of children is one and the same," or in other words, "we inherit our parents' tempers, our parents' conscientiousness, shyness, and ability, as we inherit their stature, forearm, and span." [1]

The Cumulation of Effects.—Throughout this book it has been maintained that all experiences leave their ineffaceable trace and that the effects of experience are cumulative. They are conserved in the complex, though lost as identities. In this way variations arise and are preserved through heredity. The rôle of natural selection in determining what shall be preserved is duly recognized. But natural selection is not the origin of variations. As Harris says: "Natural selection may explain the survival of the fittest, but it cannot explain the arrival of the fittest." [2] It is merely a means of continuance or preservation of them. Something more fundamental must be sought as the origin of variations. It has been assumed throughout the discussion that the living organism is susceptible of influence exerted by environing forces or by exercise. Both the physical and the mental life are susceptible of thus being modified. These modifications are conserved and become an integral, dynamic part of the resulting complex. And because of the intimate connection existing between mind and body, no considerable change in either one but has some influence upon the other.

Heredity or the conservator of racial experience, has its beginnings in memory and is subject to all the laws governing mem-

[1] *Journal Anthropological Institute*, 32 : 179–237.

[2] Hugo De Vries, *Species and Varieties: Their Origin by Mutation*, 1904, p. 825.

ory. Evolution is dependent not alone upon the transmission of parental characters, but also upon variations from the type or norm. These variations are also dependent upon the laws of memory for their appearance. Environment continually affords a variety of stimuli to act upon all organisms. They become effective because of the plasticity of nervous substance. These effects become integrated into the complex organism, rendering it still more complex. They are conserved through the processes of growth. This capacity for growth and development is a property of all living tissue and is coextensive with life itself.

In the preceding we have the explanation of the basal facts of heredity and evolution. The entire bridge between the simplest animals and the most complex has been built up in this way. The entire combination of dynamic relations existing in a given organism has become integrated together by this process. As Orr says: "The particular form of potential energy which exists in a chicken's egg, and determines into what it shall develop, did not exist in any living thing during the paleozoic era. It must have been acquired by the action of environment upon certain organisms." [1] Again he writes: "After a stimulus has acted upon an organism, and the organism has returned to what is called its normal condition, we must not suppose that the second normal condition is the same as the condition of the organism before the action of the stimulus; for the stimulus has caused a molecular change, and this change persists until some other force undoes it or intensifies it. The viscous living matter retains its impression, and is more impressionable than a solid body, of which Professor Maxwell has said, 'that the stress at any given instant depends, not only on the strain at that instant, but on the previous history of the body.'" [2]

Through long-continued repetitions both during the lifetime of an individual and during successive generations, certain processes and structures become permanent. Each factor becomes

[1] *A Theory of Development and Heredity*, p. 81.
[2] *Ibid.*, p. 98.

associated with a multitude of other factors. Before any series of similar stimuli can produce an effect which would stand out as a new individual characteristic, it must integrate itself into the existing complex and modify the entire chain of associations. The processes of growth are exceedingly tenacious in perpetuating any well-established chain of associations. This explains the difficulty of producing all at once modifications which would affect the chain of associations sufficiently to produce and perpetuate a strikingly new characteristic. The changes go on so gradually that they are unnoticed and hence it is often asserted that acquired characteristics are not transmitted. They are doubtless just as certainly transmitted as acquired. As a matter of fact, absolutely new and noticeable characteristics are not acquired during the lifetime of the individual. Little more than was potentially present at birth is present during maturity. Some fundamental change may be made, but it is too slight for detection. Furthermore, since environment is the most simple and least intense during early life, *i. e.*, during the period of plasticity, fewer modifications are effected than would be if early life were subjected to more impressive environment. Little real modification takes place after maturity is reached.

Transmission of Acquired Modifications.—The question whether modifications acquired during the lifetime of an individual may be transmitted to offspring born subsequent to the acquisition of the modifications has been the subject of protracted discussion during the last quarter of a century. Lamarck had apparently thoroughly established the theory that acquired characters are transmitted, when Weismann and Galton each independently came to conclusions absolutely at variance with it. After many years of research, Weismann, in 1892, expressed the conviction that "*all permanent—i. e., hereditary—variations of the body proceed from primary modifications of the primary constituents of the germ;* and that neither injuries, functional hypertrophy and atrophy, structural variations due to the effect of temperature or nutrition, nor any other influence of environment on the body, can be communicated to the germ cells and

so become transmissible." [1] Again he says: "We have been compelled—at least in my opinion—to consider that only those variations which are '*blastogenic*' and not those which are '*somatogenic*,' can be transmitted." [2] Weismann thus denies the possibility of the transmission of modifications acquired during the lifetime of an individual. He assumes that the germ cells contain a substance called germ-plasm, out of which the new individual is derived, one portion being used up in the development of the new body cells, the other portion passing on absolutely unchanged and forming the new germ plasm of the germ cells of the new individual. "*The new germ cells arise, as far as their essential and characteristic substance is concerned, not at all out of the body of the individual, but direct from the parent germ cell.*" [3] According to his theory the process of the development of the body cells from a part of the unchanged germ-plasm and the transmission of the remainder in an absolutely unchanged condition is continued from generation to generation. Thus the germ-plasm through the ages remains unchanged forever. The germ-plasm is thus not derived from the body cells nor subject to modifications produced in the body. "The germ cells," says Wallace, "are related to one another in the same way as are a series of generations of unicellular organisms derived from one another by a continuous course of simple division. Thus the question of heredity is reduced to one of growth. A minute portion of the very same germ-plasm from which first the germ-cell and then the whole organism of the parent were developed, becomes the starting-point of the growth of the child." [4]

Weismann's doctrine has made many converts, because the opposite is so difficult to prove objectively and because certain facts adduced by Weismann seem incontrovertible. Weismann argues that mutilations are never transmitted. He cites the negative experiments in cutting off the tails of mice through

[1] *The Germ Plasm: A Theory of Heredity*, translated by Parker and Rönnfeldt, p. 395.

[2] *Ibid.*, p. 411.

[3] Wallace, *Darwinism*, p. 438.

[4] *Ibid.*, p. 438.

nineteen generations.[1] The case is not a fair type, and it is not surprising that the results are negative. Any critical scientist would have been able to predict it.

When one considers the fundamental factors in heredity and variation, it is easy to see why mutilations would not be transmitted. The associations formed in the processes of growth have become so deep-seated that they are extremely difficult to change. The amputation of a limb or a tail after it has once grown is like trying to omit a single note in the middle of a scale that has been so long practised as to become automatic. The nervous system has repeated and thoroughly established the nervous co-ordinations which control growth in that direction. The action is in a negative direction, and according to the laws of habit in the nervous system is largely ineffective. To change a habit positive action in another direction must take place. Hence this one link in the chain of growth forces is operative in the nervous system even though momentarily disturbed by amputating the organ. The experiments performed by Brown-Séquard in producing epileptic guinea pigs by section of certain nerves are much more to the point.

Weismann's doctrine seems untenable, in the first place, because no part of a living organism remains absolutely unchanged, even through the life of that individual. Life means renewal of tissues disintegrated through life processes. As soon as this cycle of events ceases death ensues. Thus even the germ-plasm must constantly be renewed through processes of nutrition and growth. Nutrition is received through the medium of the bodily cells and therefore this elaboration of nourishment and its conveyance to the germ-plasm make the condition of the germ-plasm dependent upon the conditions of the body. This breaks down the theory that the germ cells go on from generation to generation absolutely beyond influences that may affect the body. It is scarcely thinkable also that the body may be profoundly influenced by the germ-plasm, as is claimed, and still have no reciprocal effect upon the germ-plasm.

[1] *Op. cit.*, p. 397.

Orr writes:[1] "Another objection to this theory of heredity—and it seems to me insuperable—lies in the supposition that the germ plasm may exist in the body, undoubtedly a living part of it, and still be no more affected by the changes which pass over the body, than if it were enclosed in an hermetically sealed vial. This idea seems to be based on a peculiar assumption in regard to the individuality of a cell, as though the neighboring cells of the same organism were as distinct from each other physiologically as they are morphologically; or that the cell-walls are such firm and impermeable barriers that the molecular condition of one cell might be changed without affecting its neighbor."

Eimer takes exactly the same view. He says:[2] "The germ-plasm cannot possibly, in my view, remain untouched by the influences which are at work on the whole organism during its life. Such an immunity would be a physiological miracle."

A theory mediating between Lamarckianism and Weismannism, enunciated concurrently by Baldwin, Lloyd Morgan, and Osborn, is that of organic selection. This theory maintains that environment and use modify certain characters. They are not transmitted as an inheritance to succeeding generations. Through germinal union and other causes congenital variations are constantly produced in a variety of directions. At some time variation will take place in the direction which environment is already emphasizing. Such congenital variations would of course be seized upon by natural selection and gradually intensified.

Baldwin says[3] that "Acquired characters, or modifications, or individual adaptations . . . while not directly inherited, are yet influential in determining the course of evolution indirectly. For such modifications and accommodations keep certain animals alive, in this way screen the variations which they represent from the action of natural selection, and so allow new variations in the same directions to arise in the next and following generations; while variations in other directions . . . are lost."

[1] *A Theory of Development and Heredity*, p. 8.

[2] *Organic Evolution*, p. 13.

[3] *Development and Evolution*, p. 138.

The "acquired characters," says Conn, "will serve to preserve the individual in the new conditions. . . . Each generation acquires these characters for itself so long as the conditions remain the same. But the new characters, even though not congenital, adapt the individual to its new conditions. . . . These individuals are therefore able to contend successfully in the struggle for existence, their acquired characters being just as useful to them as they would have been if congenital. This is repeated, generation after generation, similar acquired characters being redeveloped by each generation. . . . It is probable, indeed certain, that after a time some congenital variation will appear which will be of direct use to the animals in their new habits. . . . But when, perhaps after hundreds of generations, there does appear a congenital variation which aids the animal in its new habit—an old habit by this time—such variations will be selected and become a part of the inheritance of the race." [1]

The only question that needs to be raised here is what is the cause of the congenital variations? If they occur synchronously with the characters acquired by the individual through habit necessitated by environment, there is no doubt about the conclusion. But is it not very improbable that pure chance variations should ever accord with the acquired characters? There is no doubt that the real reason for the congenital variation is the accumulation of dynamic relations produced by the very environment or through continued use in a given direction. The congenital variation has not come by chance but as a definite result of energy applied in a specific direction sufficient to produce motion in that direction. The growth and development is a resultant of many forces. The doctrine of the conservation of energy points unequivocally to this conclusion. Dr. G. Stanley Hall says: "Unless we insist upon extreme Weismannism, as few biologists now do, we must admit that the child born of generations of cultured ancestry has some advantage, even though these do not live to see their birth, over those born of the lowest classes, postnatal environment and nurture being

[1] *The Method of Evolution*, p. 305.

the same in the two cases. If this be so, each generation ought to add a little, infinitesimal though it be, to progress in that most ancient form of wealth and worth which birth bestows. If the old phrase that an ounce of heredity is worth a ton of education have any truth in it, rotation of classes, while it may have many advantages, is thus bought at a very dear price." [1]

Romanes wrote very definitely on this point, saying: "Mr. Darwin's theory does not, as many suppose that it does, ascribe the origin and development of all instincts to natural selection. This theory does, indeed, suppose that natural selection is an important factor in the process; but it neither supposes that it is the only factor, nor even that, in the case of numberless instincts, it has had anything at all to do with their formation. Take, for example, the instinct of wildness, or of hereditary fear as directed toward any particular enemy—say man. It has been the experience of travellers, who have first visited oceanic islands without human inhabitants and previously unvisited by man, that the animals are destitute of any fear of man. Under such circumstances the birds have been known to alight on the heads and shoulders of the new-comers, and wolves to come and eat meat held in one hand while a knife was held ready to slay them with the other. But this primitive fearlessness of man gradually *passes into an hereditary instinct of wildness*, as the special experiences of man's proclivities accumulate; and as this instinct is of too rapid a growth to admit of our attributing it to natural selection (not one per cent. of the animals having been destroyed before the instinct is developed) we can only attribute its growth to the effects of inherited observation. In other words, just as in the lifetime of the individual, adjustive actions which were originally intelligent, may, by frequent repetition become automatic, so, in the lifetime of the species, actions originally intelligent may, by frequent repetition and heredity, so unite their efforts on the nervous system that the latter is prepared, even before individual experience, to perform adjustive actions mechanically which, in previous generations, were performed intelligently.

[1] *Pedagogical Seminary*, X, p. 306.

This mode of origin of instincts has been appropriately called the 'lapsing intelligence,' and it was fully recognized by Mr. Darwin as a factor in the formation of instinct." [1]

Cope in discussing the gradual evolution of new forms through progressive increments of structure says that either these changes are inherited or each generation must develop the structural changes for itself. This latter view he believes incorrect. He says:[2] "It is only necessary to examine the embryonic history of animals to show that it is entirely untenable. For if some or all of these acquired characters can be found present in the early stages of growth, as in the egg, the pupa, the fœtus, etc., it becomes clear that such acquired characters have been inherited. That such is the fact is abundantly demonstrated by embryological researches. This fact alone is sufficient to set at rest by an affirmative answer the question as to the inheritance of acquired characters. And that this answer applies to all time and to all evolution is made evident by the fact, which is disclosed by paleontology, that all characters now congenital have been at some period or another acquired." In refutation of the stock argument that mutilations are non-transmissible he writes cogently: "Such negative evidence only demonstrates that such modifications of structure *may not* be inherited. A single undoubted example of the inheritance of a mutilation would prove that no insurmountable barrier to such inheritance exists. And well-authenticated examples of such cases are known and will be mentioned later on."

Special Evidences of Heritability of Acquired Characters.—In support of his contention, Cope brings forward three lines of evidence, viz.: (1) From embryology; (2) from paleontology; (3) from the breeding of animals. Under the first he cites the probable fact "that the segments of the body and limbs of the Arthropoda were originally produced by the movements of definite tracts on each other, during the period that the external surfaces were becoming hardened by chitinous or calcareous

[1] Romanes's *Essays*, pp. 30–32.

[2] *Primary Factors of Organic Evolution*, p. 401.

deposits. It is well known that this segmentation is no longer produced by this mechanical cause during the adolescent or any other post-embryonic stage of the life of the individual, but that it appears during the various stages of embryonic life, and is therefore inherited."[1] He mentions also the fact that during a certain stage of embryonic development of the rat the enamel-producing layer of the molar teeth undergoes a degeneration. The ancestors all possessed fully enamelled teeth at maturity, but lost the enamel through the abrasions due to ordinary use. This has reacted upon the functional activity of the enamel-producing structure during embryonic life. He regards this as a case of the transmission of mutilations incurred in the ordinary struggle for existence. Mutilations suffered in this way produce vital changes in metabolism and thus tend to become so permanently fixed as to be transmitted.

In adducing paleontological evidence he demonstrates the gradual changes which occurred in the shells of the series of the nautiloid Cephalopoda during the successive geologic ages. In concluding his extended and convincing discussion he quotes Hyatt, from whom the particular facts are mainly secured: "These cumulative results favor the theory of tachygenesis (acceleration) and diplogenesis, and are opposed to the Weismannian hypothesis of the subdivision of the body into two essentially distinct kinds of plasm, the germ-plasm, which receives and transmits acquired characteristics, and the somatoplasm, which, while it is capable of acquiring modifications, either does not or can not transmit them to descendants."[2]

The evidence from breeding is largely drawn from the authoritative writings of Prof. Wm. H. Brewer of Yale University, long president of the Agricultural Society of Connecticut. Modifications are due to several different causes, such as (*a*) changes in nutrition, (*b*) exercise or disuse of function, (*c*) disease, (*d*) mutilation or injuries, (*e*) regional influences, *i. e.*, change in locality. Brewer shows that breeders increase the size of a breed very largely by feeding, of course not ignoring

[1] *Loc. cit.*, p. 404. [2] *Ibid.*, p. 422.

selection. But no successful attempt can be made by selection alone. "All the best breeders recognize the rule laid down by Darwin, that those characters are transmitted with most persistency which have been handed down through the longest line of ancestry. Breeders do not believe that the characters acquired through the feeding of a single ancestor, or generation of ancestors, can oppose more than a slight resistance to that force of heredity which has been accumulated through many preceding generations, and is concentrated from many lines of ancestry. Yet the belief is universal that the acquired character due to food during the growing period has *some* force, and that this force is cumulative in successive generations. All the observed facts in the experience with herds and flocks point in this direction."

Brewer shows how the trotting-horse has been gradually evolved through the cumulative results of heredity. In 1818 the lowest record for the mile was 3 minutes. During the next six years this record was reduced to 2:34, probably largely the result of training. But the limits that could be attained by this means had been practically reached, for during the next ten years the record was lowered only 2½ seconds, and twenty-one years more elapsed before the record was reduced to 2:30. By 1858 a 2:30 class was established, but with only a half-dozen horses with that speed. Brewer says: "Now we began to have distinctly trotting blood, and heredity began to tell." By 1868 the record had been lowered 5 seconds more, and there were fully 150 in the 2:30 class. By 1888 there were 3,255 in the 2:30 class, and the record was reduced 4 seconds more. Now we have a record below 2:04, and probably a hundred in the 2:10 list, and a thousand in the 2:20 list. The evolution of the pacer during the last century from the 3-minute class to the 2-minute class has been equally remarkable.

Cope cites a large number of cases reported by eminent observers of the transmission of mutilations. He cites such cases as the transmission of ophthalmia in a horse, the loss of an eye in fowls, a split pastern-joint in a horse, a cat with a deformed tail,

etc. Deformed fingers, a broken knee-pan, and other accidentally acquired characters are reported to have been transmitted through succeeding generations of human beings.

Cope says[1] that not only are structural characteristics inherited by offspring, "but the functionings of organs which depend on minute histological peculiarities are inherited. Such are points of mental and muscular idiosyncrasy; of weakness and strength of all or any of the viscera, and consequent tendencies to disease or vigor of special organs. Darwin has collected in his work, *The Descent of Man*, numerous instances of the inheritance of various tricks of muscular movements of the face, hands, and other parts of the body."

Shall we not believe with Cope and Brewer that the gradual change in the texture of wool of sheep taken from one region to another, the modification of the hoofs of horses taken from lowlands to mountainous regions, the gradual acclimatization of plants taken from moist to desert regions or from higher to lower altitudes, or from tropical to temperate zones, are all examples of the gradual accumulations of tendencies or acquired characters which are transmitted, thus changing the entire nature of the breed or species?

Eimer states his views definitely, saying:[2] "It can, I believe, be proved as a fact that acquired characters are inherited. . . . Single cases of the inheritance of injuries only once incurred seem to me to be thoroughly authenticated." Rudimentary organs in his judgment are proof of the inheritance of modifications produced by injuries. He maintains that: "All the results of cultivation which man successfully produces in plants and animals, and for thousands of years has produced, prove . . . most incontestably the fact that acquired characters are hereditary." He further says: "That characters acquired through use or disuse are inherited, and must therefore aid in the formation of new species, can, I believe, be proved more easily than any other proposition I am maintaining. If I were to bring together all the facts which could be used as evidence on

[1] *Loc. cit.*, p. 398. [2] *Organic Evolution*, pp. 13, 100, 154.

this point, I should never come to the end of them, for I should have to refer to all the facts of comparative anatomy and physiology. But I intend to show in particular that use and disuse by themselves must lead to the formation of new permanent characters, without the aid of selection, for even this I hold to be a physiological necessity."

In a very long chapter on "Acquired Characters," and a subsequent one on "Degeneration," Eimer sets forth at great length his belief in the transmission of acquired characters. He cites a great many examples of the transmission from parent to child of some injury or modification acquired during the lifetime of the parent. He does not regard these specific cases as necessary to prove his position, although they seem to be convincing, since the whole development of instincts, varieties and species, or in fact all gradual changes of structure and function within species, are wholesale illustrations of the same law. He argues properly that insanity, idiocy, mental degeneracy, the extinction of families through drunkenness and disease, are all specific evidences of cumulative effects conserved through heredity.

According to Darwin, the families of drunkards become extinct in the fourth generation. Marcé gives the following order of degeneration in such cases: First generation: Moral depravity, excessive indulgence in alcohol. Second generation: Drink mania, maniacal attacks, general paralysis. Third generation: Hypochondria, melancholia, tædium vitæ, impulse to suicide. Fourth generation: Imbecility, idiocy, extinction of the family.[1] Spencer says very emphatically: "Either there has been inheritance of acquired characters or there has been no evolution." Dr. Cutter says[2] that: "Not only the natural constitution of the parents may be inherited, but their acquired habits of life, whether virtuous or vicious. . . . Even when the identical vice does not appear, there is a morbid organization and a tendency to some vice akin to it. Not only is the evil tendency transmitted, but what was the simple practice, the voluntarily

[1] Given by Eimer, *op. cit.*, p. 200.
[2] *Comprehensive Physiology*, p. 224.

adopted and cherished vice, of the parent, becomes the passion, the overpowering impulse, of the child. A person is thus often handicapped for life by the mistakes and faults of his ancestors. . . . Every formation of body, internal and external, all intellectual endowments and aptitudes, and all moral qualities, are or may be transmissible from parent to child. If one generation is missed, the qualities may appear in the next generation (atavism). A guilty secret may thus reveal itself long after the active participators in it have passed from this life."

W. T. Harris writes:[1] "The mole hunts earthworms and proceeds by minute steps of conceiving a purpose, and of realizing this purpose, until it produces an hereditary change in its physique. The disuse of organs causes their diminution in the individual in the course of its own life, and after several generations the effect becomes visible as an inheritance, as a diminution or utter extinction of eyesight."

Darwin is frequently cited as one of the great opponents of the theory of the transmission of acquired characters. It is true that selection, natural and artificial, was the great principle which he invoked to explain the origin of species, but it is entirely erroneous to believe that he regarded that as the sole cause. He distinctly says:[2] "I am convinced that natural selection has been the most important, but not the exclusive, means of modification." Although Darwin did not stress the idea of the transmission of acquired characters, yet it seems clear that he recognized it and he undoubtedly collected the largest array of evidence ever gathered which supports this view. His discussions of the variation of plants and animals under domestication and other forms of changed environment, the effects of use and disuse, laws of variation, the origin of species, the origin and development of instincts, all point unequivocally in the same direction. A few quotations will be adduced to corroborate this interpretation of his views. In his section on the effects of habit and of the use or disuse of parts he writes: "Changed habits pro-

[1] Preface to Judd's *Genetic Psychology for Teachers*, p. 7.
[2] *Origin of Species*, p. 5.

duce an inherited effect as in the period of the flowering of plants when transported from one climate to another. With animals the increased use or disuse of parts has a more marked influence; thus I find in the domestic duck that the bones of the wing weigh less and the bones of the leg more, in proportion to the whole skeleton, than do the same bones in the wild duck; and this change may be safely attributed to the domestic duck flying much less, and walking more, than its wild parents. . . . Not one of our domestic animals can be named which has not in some country drooping ears; and the view which has been suggested that the drooping is due to disuse of the muscles of the ear, from the animals being seldom much alarmed, seems probable." [1]

In discussing the laws of variation he says:[2] "It is very difficult to decide how far changed conditions, such as of climate, food, etc., have acted in a definite manner. There is reason to believe that in the course of time the effects have been greater than can be proved by clear evidence." It is just this gradual accumulation which many now feel bold enough to consider as the great source of visible modifications. "From the facts alluded to in the first chapter, I think there can be no doubt that use in our domestic animals has strengthened and enlarged certain parts, and disuse diminished them; and that such modifications are inherited. . . . The evidence that accidental mutilations can be inherited is at present not decisive; but the remarkable cases observed by Brown-Séquard in guinea pigs, of the inherited effects of operations, should make us cautious in denying this tendency. . . . The eyes of moles and of some burrowing rodents are rudimentary in size, and in some cases are quite covered by skin and fur. This state of the eyes is probably due to gradual reduction from disuse, but aided perhaps by natural selection. . . . In some of the crabs the foot-stalk for the eyes remains, though the eye is gone; the stand for the telescope is there, though the telescope with its glasses has been lost. As it is difficult to imagine that eyes, though useless, could be in any way injurious to animals living in darkness, their loss may be

[1] *Origin of Species*, p. 10. [2] *Ibid.*, p. 127.

attributed to disuse." His discussion of the origin of instincts corroborates the same theory. He says:[1] "If we suppose any habitual action to become inherited—and it can be shown that this does sometimes happen—then the resemblance between what originally was a habit and an instinct becomes so close as not to be distinguished. . . . As modifications of corporeal structure arise from, and are increased by, use or habit, and are diminished or lost by disuse, so I doubt not it has been with instincts." Especially good illustrations of instincts acquired by use or lost through disuse are those which have appeared or have been modified by the domestication of animals. Darwin devotes an entire section to cases of "inherited changes of habit in domesticated animals." [2]

The Fundamental Difference Between the Theories.—Undoubtedly much of the difference between the Weismannians and the opponents of the theory is due to the difference in meaning of the term "acquired character." Brooks, in his *Foundations of Zoology*, says that he never uses the phrase "inheritance of acquired characters" except under protest. He says: "If any assert that the dog inherits anything which his ancestors did not acquire, their words seem meaningless; for, as we use words, everything which has not existed from the beginning must have been acquired—although one may admit this without admitting that the nature of the dog is, wholly or to any practical degree, the inherited effect of the environment of his ancestors."

We should agree with the Weismannians that a sharp distinction should be made between inborn changes, those which they insist are *germinal variations*, and those called bodily modifications. Undoubtedly no modifications except germinal modifications can be transmitted. But may not acquired bodily modifications produce germinal modifications? In fact, it hardly seems thinkable that normal modifications of the germ can be produced in any other way than through the medium of the blood, *i. e.*, the body. It seems unscientific to speak of germinal modifications occurring without cause. "Sports" and "chance

[1] *Origin of Species*, p. 243. [2] *Ibid.*, p. 247.

variations" should not be considered as scientific categories. A functional or dynamic relation rather than a mechanical substance relation undoubtedly obtains between the germ and the developed individual. Then why is it not possible to have the bodily character exert a profound dynamic influence upon the germ-plasm without the intervention of gemmules, ids, or determinants as the bearers of heredity? The "arrival of the fittest" can then be explained on the assumption of dynamic forces which become sufficiently cumulative to cause the germ to function in new ways. It is, of course, recognized that the union of two germ-cells may produce a new individual differing from either, but this could not account for their producing modifications just like the particular acquired modifications of the bearer of either of the cells.

Weismann may be correct, but his theories at least are not proven and rest upon purely imaginative interpretations without experimental evidence. Morgan says apropos of this point of v ew: "Weismann has piled up one hypothesis on another as though he could save the integrity of the theory of natural selection by adding new speculative matter to it. The most unfortunate feature is that the new speculation is skilfully removed from the field of verification, and invisible germs, whose sole functions are those which Weismann's imagination bestows on them, are brought forward as though they could supply the deficiencies of Darwin's theory. This is, indeed, the old method of the philosophizers of nature. . . . The worst feature of the situation is not so much that Weismann has advanced new hypotheses unsupported by experimental evidence, but that the speculation is of such a kind that it is, from its very nature, unverifiable, and therefore useless." [1]

Thomson, though believing in Weismann's position, is cautious and says that "we do not know of any instance of the transmission of an acquired character." He further observes that "those who give an affirmative answer have not succeeded in proving their case; as for the other side, how can they prove

[1] T. H. Morgan, *Evolution and Adaptation*, 1903, p. 165.

a negative? Therefore, while we have no hesitation as to the verdict of 'non-proven' to which the evidence *at present available* points, we do not expect a satisfactory issue until many years of experimental work have supervened." [1] He says that "The Lamarckian position is still stoutly maintained—usually in more or less modified form—by many prominent naturalists, especially in France and America." [2]

Delage says: "Il n'est pas démontré que les modifications acquises sous l'influence des conditions de vie soient généralement héréditaires, mais il paraît bien certain qu'elles le sont quelquefois. Cela depend sans doute de leur nature." Thomson, who quotes the above, does not agree to it, but says: "This is the opinion of one of the acutest of living biologists." [3] Even Thomson, who is a believer in Weismannism, says: "It must be admitted, therefore, that it is quite erroneous to think of the germ-cells as if they led a charmed life, uninfluenced by any of the accidents and incidents in the daily life of the body which is their bearer. But no one believes this, Weismann least of all, for he finds the chief source of germinal variations in the stimuli exerted on the germ-plasm by the oscillating nutritive changes in the body." [4]

Importance of the Question.—The question as to the transmissibility of acquired characters, says Thomson, is more than a purely academic one, and more than a technical problem for biologists. "Our decision in regard to it affects not only our whole theory of organic evolution, but even our every-day conduct. The question should be of interest to the parent, the physician, the teacher, the moralist, and the social reformer—in short, to us all." [5]

Educational Bearings of Heredity.—*Predispositions.*—The facts of heredity properly set forth carry with them so clearly the educational bearings that it will not be necessary to dwell at great length upon this phase of the subject. A few conclusions will, however, be suggested.

[1] *Heredity*, p. 166. [2] *Op. cit.*, p. 172. [3] *Op. cit.*, p. 164.
[4] *Op. cit.*, p. 203. [5] *Op. cit.*, p. 165.

Physically and intellectually each individual has a predetermined norm toward which he tends to grow. Favorable environment will develop these qualities to the fullest extent. If environmental circumstances are especially auspicious it is possible that natural tendencies may be stressed and hereditary endowments slightly augmented during the lifetime of the individual. But the individual is predestined to grow about so tall, so heavy, to have a given memory, a certain type of imagination, etc. Predestination in these matters is just as certain as in the case of blue or gray eyes, black or red hair, blonde or brunette skin, regular or crooked teeth, and dozens of other characteristics which every one would concede are unmodified or only slightly affected by environment. Crack oarsmen, base-ball and football stars, sprinters, pole-vaulters, singers, and artists are not created by any school. They are simply discovered, and sometimes developed. Much the same is true of poets, orators, musicians, and mathematicians.

Teachers frequently become weighed down with the importance of their mission which they have misconstrued. They assume that their main function is to create rather than to develop. In view of this they often carry undue loads of responsibility concerning the outcome of their efforts, and also assume altogether too much credit for the success of pupils who win in after life. They say: "Senator So-and-So, Judge So-and-So, were my pupils." Colleges frequently use such material for advertising. But further than being a selective agency and stimulating the individuals to develop themselves to their maximum capability, the institution does little in causing its students to become great. It may cause them to achieve greatness, but it does not give them greatness. In fact, were they not born potentially great they could never achieve greatness.

Limits of Education.—"As illustrative of the inability of education or training to develop mental powers beyond the limit of hereditary endowment, it may be mentioned that children of inferior races often manifest a marvelous quickness of understanding during the earlier stages of an European education, but

soon, and abruptly, come to a point beyond which their intellectual development cannot be carried. Thus the Hawaiians have an excellent memory and learn by heart with remarkable ease, but it appears impossible to develop their reasoning power. In New Zealand, the ten-year-old children of the natives are said to be more intelligent than the English children of the same age, but, with very rare exceptions, they are incapable of ever reaching the mental ability ultimately attained by the latter. On the other hand, the children of the Brahmins, sprung from a caste which has been highly cultured through very many generations, exhibit great intelligence and especially an acuteness in reasoning, whereby they show themselves vastly superior to the other natives of India."[1]

Similar observations have been frequently made regarding negro children. Up to the age of ten or eleven they appear even precocious. After that age the rate of progress decreases in a marked degree. Before that time they frequently outstrip the white children. After that time they become hopelessly behind in the race. The higher powers have not sufficiently well-developed hereditary tendencies to produce growth equal to that in the whites.

History of Twins.—Sir Francis Galton in his very interesting study of twins draws several conclusions of much value in studying the relation between heredity and environment. He clearly shows that although twins are given the same food, the same physical surroundings, the same schooling, the same social and mental environment, and in every way treated as nearly alike as possible, they often develop as differently as if they were in no way related. They may differ in height, weight, personal appearance, social disposition, and mental characteristics. The differing initial prepotentialities are stronger than any food, environment, or training that could be given. This should not be wondered at, for may not two animals of different species consume absolutely the same kind and amount of food and yet develop along absolutely different lines? These lines of

[1] McKim, *Heredity and Human Progress*, p. 268.

evidence justify, in Galton's opinion, the following general statements:

"We may, therefore, broadly conclude," says Galton, "that the only circumstance, within the range of those by which persons of similar conditions of life are affected, that is capable of producing a marked effect on the character of adults, is illness or some accident which causes physical infirmity. . . . The impression that all this leaves on the mind is one of some wonder whether nurture can do anything at all, beyond giving instruction and professional training. . . . There is no escape from the conclusion that nature prevails enormously over nurture when the differences of nurture do not exceed what is commonly to be found among persons of the same rank of society and in the same country." [1]

Implications of Weismannism.—According to the doctrine of Weismann, education of the individual will have no hereditary effect upon his posterity. Nothing that the individual does or accomplishes during his life can affect the germ-plasm or consequently his offspring. Through the example of the parent the education of the offspring may be very much affected to be sure, but it is not a result of inheritance. The most dissolute living would also be without prejudicial hereditary effects upon children born after such living. In explaining the consequences of the theory, Conn says: [2] "Whatever be the life that the parents lead, whether of the most ennobling or the most debasing character, this will not modify the characters which the offspring would receive. . . . Imagine two individuals with the same congenital characters, and suppose that one is placed in circumstances which lead him to the lowest stages of dissipation, while the other is surrounded by conditions which lead him to live a most upright, moral life; imagine that each has a son who is separated at once from his parent and brought up under identical conditions; it would follow that each of the boys would show the same inherited characters. The profligate life

[1] "History of Twins," in *Inquiries into Human Faculty*, pp. 235, 240, 241.
[2] *The Method of Evolution*, p. 209.

of the one parent and the upright life of the other would not count in inheritance. . . . From such considerations it would follow that the only control that a man has over the inheritance of his children is in selecting his wife."

Importance of Selection.—On the other hand, a great responsibility is placed upon each individual to *aid natural selection* in allowing only the best qualities of the race to be transmitted. Even if Weismannian theories be correct, the problem of the advance of civilization is not hopeless. If acquired modifications are transmitted, the results are the more controllable and certain. It is certain that education should so enlighten each generation that it would limit the propagation of the species to those only who possess desirable physical and mental qualities. Education should aid in the determination of the ideals of life to be sought, and the means of best attaining these. The social heredity transmitted from generation to generation should thus become richer and nobler.

There is certainly great need of wise measures to prevent the perpetuation and multiplication of many undesirable elements of society. Those with hereditary disposition to loathsome disease, the insane, the hopelessly defective, and the habitual criminal, should not only be effectively isolated from society, but they should be prevented from marrying and encumbering the earth with their kind. They are a perpetual menace to society and an absolute means of preventing the elevation of the general plane of society. Their presence constitutes an effective check upon physical, mental, and moral progress. This is in part because the expense entailed in maintaining such a class prevents the rearing of others who would be progressive factors. Then their presence contaminates the morals of the children of the righteous. They are to be feared as a pestilence. They are gangrenous members which should be excised from the rest of the body social with the utmost promptitude.

Just what means should be adopted to aid in such a selective process is a question. It is not second in importance to any other. Various means have been suggested at different times

and a few have been tried. The Spartans afford an example of the most thoroughgoing attempt. The new-born babe was examined by a state official appointed for the purpose. All weaklings and defectives were at once put to death, we are told. In just what manner is a matter of dispute. Vigorous and physically perfect children were permitted to live, and at once adopted by the state. Henceforth to full maturity the physical development of the child was a matter of supreme concern. Physical exercise constituted the most important part of the education of both boys and girls. Marriage was compulsory and under supervision of the state. The women of Sparta had but one recognized function, that of furnishing physically perfect citizens for the service of the state. The type of physical perfection attained has nowhere else been equalled. Moral and intellectual greatness were neglected and resulted in the final overthrow of Sparta by a less hardy, but more intellectual people. The downfall was not a consequence of physical vigor, but because of the absence of that which is still higher.

In many States the prohibition of the marriage of imbeciles and of idiots has been considered. Laws have been projected in various places to require an educational test for marriage. Why are not certain educational qualifications as sensible prerequisites for matrimony as for suffrage? Connecticut recently passed a law providing that no man or woman who is known to be epileptic, imbecile or feeble-minded shall marry. The direful consequences of allowing epileptics and the feeble-minded to become parents are just beginning to be appreciated.[1] McKim tells us[2] that "Echeverria, after ten years' careful research into the character of the offspring of epileptics . . . found that 62 male and 74 female epileptics produced 553 children. Of these latter, 22 were still-born; 195 died during infancy from spasms; 78 lived as epileptics; 18 lived as idiots;

[1] There is a very definite movement in many States to pass laws restricting the marriage of the above classes. Other laws have been adopted in some States. See Fisher, *Report on National Vitality*, 1909, p. 51.

[2] *Heredity and Human Progress*, p. 145.

39 lived as paralytics; 45 were hysterical; 6 had chorea; 11 were insane; 7 had strabismus; 27 died young from other causes than nervous diseases. Thus out of the 553 children, 448 died early or were gravely afflicted, while 105, or less than one-quarter of the whole number, were healthy."

The principal of the New York Institute for the Deaf and Dumb wrote that resulting from 833 marriages where both parents were deaf, out of 3,942 children born, 1,134 were defectives, 308 of them being idiots, 145 deaf and dumb, 98 deformed, 60 epileptics, 85 blind, 38 insane, 300 scrofulous, 883 died young. Dr. S. G. Howe, in studying the causes of idiocy in Massachusetts, found 114 idiotic persons whose parents were known to be habitual drunkards, 419 came from scrofulous families, 211 had some near relatives either insane or idiotic, 49 had one near relative idiotic, 50 had parents one or both of whom were idiots or insane.

David Starr Jordan, who is a believer in Weismannism, says that "So far as science knows, education and training play no part in heredity.[1] The change in the blood which is the essence of race progress, as distinguished from progress in civilization, finds its cause in selection only. . . . Evil influences may kill the individual, but they cannot tarnish the stream of heredity. The child of each generation is free-born so far as heredity goes, and the sins of the fathers are not visited upon him." He says further that by proper selective breeding it is possible to produce wonders. "Almost anything may be accomplished with time and patience." He maintains that nations have died out or become degenerate simply because they have sent all their best blood to war. "Greece died because the men who made her glory had all passed away and left none of their kind." The wars of France explain the French "Man with the Hoe." "Spain died of empire centuries ago. She has never crossed our path. It was only her ghost which walked at Manila and Santiago."[2]

[1] I cannot subscribe to the idea that education and training play no part in heredity, but I do recognize the importance of selection.

[2] *The Blood of the Nation.* See also his recent book, *The Human Harvest.*

Sir Francis Galton has made observations in the same direction. He shows how the Spanish nation has been drained of its best blood through persecutions for one reason or another. Every year between 1471 and 1781 an average of 1,000 persons condemned for free thinking were executed. These were the strongest intellects. During those three centuries, 32,000 were burnt and 117,000 burnt in effigy (and most of these died in prison). During the same period, 291,000 were condemned to imprisonment for similar offences.

During the Middle Ages celibacy was thought by thousands of the choicest spirits to be an absolute condition of righteousness, with the consequence that many of the best men of the time left no posterity. Thus the rudest portion of the community were left to be the parents of succeeding generations. Thus were practised, says Galton, "the arts which breeders would use, who aimed at creating ferocious, currish, and stupid natures. No wonder that club law prevailed for centuries over Europe; the wonder rather is that enough good remained in the veins of Europeans to enable their race to rise to its present very moderate level of natural morality." [1] He goes so far as to say that the Dark Ages in Europe were largely due to the disastrous results of celibacy. He also points out that the English universities encouraged celibacy by offering their fellowships and other honors to their most talented sons on one condition, namely, that they should not marry. As those positions have a life tenure, include free board, lodging, a reasonable income, good society, and opportunity for scholastic pursuits, they are eagerly accepted. Through this a great national loss is entailed. One of the seeming penalties of higher education and civilization is that of bequeathing the world to the children of the peasantry and of the slums. With higher standards of life fewer marriages take place and fewer children are born into each family.

Galton on Heredity and Limits of Education.—To prove that heredity and not training is responsible for great mental ability, Galton [2] states that the majority of those who gained the greatest

[1] *Hereditary Genius*, p. 344.

[2] *Ibid*, p. 15.

mathematical prizes at Cambridge were boys who had received practically no training before going to Cambridge. They competed with boys from the "Great Public Schools" who had been coached all their lives to the limit of their capacities. But few of the latter class ever became "senior wranglers," *i. e.*, won the highest place in the competitive examinations. Galton claims that children born of exceptionally gifted parents stand "an enormously greater chance of turning out to be gifted in a high degree" than children born of mediocre parents.

Many of the greatest students of juvenile criminals are convinced that heredity is responsible for the criminality of that portion of juvenile offenders who cannot be reformed. Of the juvenile prison population a large percentage are descendants of such feeble stock that they have lost their parents early in life. In these extreme cases no amount of education and no quality of environment would have been adequate to redeem them to society. Maudsley said on this point:[1] "It is an indisputable though extreme fact that certain human beings are born with such a native deficiency of mind that all the training and education in the world will not raise them to the height of brutes; and I believe it to be not less true that, in consequence of evil ancestral influences, individuals are born with such a flaw or warp of nature that all the care in the world will not prevent them from being vicious or criminal or becoming insane. Education, it is true, may do much; . . . but we cannot forget that the foundations on which the acquisitions of education must rest are not acquired, but inherited."

Galton does not believe that education can do much for the genius, by which term he means merely the eminently gifted. In fact, he does not believe that education can very materially change the nature of any individual. He says that all types "breed true" to their kind, and consequently one's ancestry predestines one to a given sphere of existence. Individual equality is unthinkable and should not be taught. He says:

[1] *Body and Mind*, p. 68.

"I have no patience with the hypothesis occasionally expressed, and often implied, especially in tales written to teach children to be good, that babies are born pretty much alike, and that the sole agencies in creating differences between boy and boy, and man and man, are steady application and moral effort. It is in the most unqualified manner that I object to pretensions of natural equality. The experiences of the nursery, the school, the university, and of professional careers, are a chain of proof to the contrary. I acknowledge freely the great power of education and social influences in developing the active powers of the mind, just as I acknowledge the effect of use in developing the muscles of a blacksmith's arm, and no further. Let the blacksmith labor as he will, he will find there are certain feats beyond his power that are well within the strength of a man of herculean make, even though the latter may have led a sedentary life."

Every man, says, Galton, finds his natural level. He competes with many, distances some, and is distanced by others. He may try in various lines but with quite similar results. Barring a certain amount of advantage coming from opportunity and encouragement and similar disadvantages due to a lack of opportunity, Galton's conclusions are undoubtedly correct. Difficulties and discouragement serve to repress mediocre individuals more than the great. This must include moral greatness. On the other hand, encouragement and opportunity mean little to the idiot or weak-minded. Hence the great middle class are the most benefited by educational opportunities. He says: "If a man is gifted with vast intellectual ability, eagerness to work and power of working, I cannot comprehend how such a man should be repressed. The world is always tormented with difficulties waiting to be solved—struggling with ideas and feelings, to which it can give no adequate expression. If, then, there exists a man capable of solving those difficulties, or of giving a voice to those pent-up feelings, he is sure to be welcomed with universal acclamation. We may almost say that he has only to put his pen to paper and the thing is done. I am here

speaking of the very first-class men—prodigies—one in a million, or one in ten millions."[1]

He remarks further:[2] "I feel convinced that no man can achieve a very high reputation without being gifted with very high abilities." He even maintains that those who possess great capacity will find opportunity to manifest it, even though early training be neglected.

Testimony from Neurology.—"In the association areas our memory records of past experiences and their connections are laid down in some, as yet unknown, material change in the network of nerve cells and fibres. Here, as elsewhere in the nervous system, it may be supposed that the efficiency of the nervous machinery is conditioned partly by the completeness and character of training, but largely also by the inborn character of the machinery itself. The very marked differences among intelligent and cultivated persons—for instance, in the matter of musical memory and the power of appreciating and reproducing musical harmonies—cannot be attributed to differences in training alone. The gifted person in this respect is one who is born with a certain portion of his brain more highly organized than that of most of his fellow-men. This general conception that the special capacities of talented individuals rest chiefly upon inborn differences in structure or organization of the brain may be regarded as one outcome of the modern doctrine of localization of functions in this organ. In the beginning of the nineteenth century it seems to have been the general view that those who had a high degree of mental capacity might direct their activity with equal success in any direction according to the training received. A man who could walk fifty miles to the north, it was said, could just as easily walk fifty miles to the south, and a man whose training made him an eminent mathematician might, with different training, have made an equally eminent soldier or statesman. In our day, however, with our ideas of the organization of the brain cortex, and our knowledge that different parts of this cortex give different reactions in con-

[1] *Hereditary Genius*, p. 35.

[2] *Ibid.*, p. 43.

sciousness, it seems to follow that special talents are due to differences in organization of special parts of the cortex." [1]

Donaldson says,[2] from a study of the nervous system and its development, that "The general relations of formal education to the growing process are fairly evident, the function of it is to round out the original framework of the central system, in accordance with the natural provisions there present. Without question there is something very fatalistic in this. No amount of education will cause enlargement or organization where the rough materials, the cells, are wanting; and on the other hand, where these materials are present, they will, in some degree, become evident, whether purposely educated or not."

Donaldson further writes: [3] "Education must fail to produce any fundamental changes in the nervous organization, but to some extent it can strengthen formed structures by exercise, and in part waken into activity the unorganized remnant of the dormant cells. No amount of cultivation will give good growth where the nerve cells are few and ill-nourished, but careful culture can do much where there are those with strong inherent impulses toward development. On neurological grounds, therefore, nurture is to be considered of much less importance than nature, and in that sense the capacities that we most admire in persons worthy of remark are certainly inborn rather than made."

Thorndike writes: [4] "The importance to educational theory of a recognition of the fact of original nature and of exact knowledge of its relative share in determining life's progress is obvious. It is wasteful to attempt to create and folly to pretend to create capacities and interests which are assumed or denied to an individual before he is born. The environment acts for the most part not as a creative force, but as a stimulating and selective force. We can so arrange the circumstances of nurture as to reduce many undesirable activities by giving them little

[1] W. H. Howell, *Text-Book of Physiology*, pp. 220–221.

[2] *Growth of the Brain*, p. 355. [3] *Op. cit.*, p. 343.

[4] *Educational Psychology*, p. 44.

occasion for appearance, and to increase the desirable ones by insuring them an adequate stimulus. We can, by the results we artificially attach to wisdom, energy, or sympathy, select them for continuance in individual lives. But the results of our endeavors will forever be limited as a whole by the slow progress of change in the original nature of the race, and in different individuals by inborn talents and defects. . . . The one thing that educational theorists of to-day seem to place as the foremost duty of the schools—the development of powers and capacities—is the one thing that the schools or any other educational forces can do least."

Physical, Mental, and Moral Correlations.—A study of heredity emphasizes the correlation between mind and body and between intellectual and moral life. In the great majority of cases criminality is an accompaniment, possibly a consequence, of bodily defect. Dr. MacMillan of the Child Study Department of the Chicago schools is confident that bodily defects coexist with mental defects even when it is impossible to detect them by ordinary means. Morrison claims that among juvenile offenders, a high percentage are developed feebly on the physical side. "The physical basis of mental life is in a worse condition amongst juvenile offenders as a body than amongst the ordinary population."

Social Heredity and Morality.—Moral qualities are much less determined by biological heredity than are physical and mental. They are much more coefficients of environment and social heredity. Biological heredity is largely determinative of physical size and strength and mental power, while environment largely determines what use will be made of them. I have emphasized the correlation between physical development and criminality, but I have also pointed out the fact that about eighty per cent. of all juvenile offenders are reformable. Every one knows of the Apollos in physical development who are the basest kind of scoundrels and of persons with puny, undeveloped, diseased bodies coupled with beautiful characters. Of course no one can ever develop the highest type of positive moral char-

acter without possessing abundant mental power and vigor. Mediocre intellectuality can never be coupled with the highest morality. There must be vigor of brain to have vigor of mind, and there must be vigor of mind to have moral vigor. But I cannot subscribe to the theories of Lombroso and his school of criminologists who maintain that facial and other external bodily features are an absolute index to mental and moral qualities.

The use to which we devote our mental and physical powers is largely a moral question. Most people know sufficiently well what they ought to do and what they ought to avoid. Though great ignorance still prevails, yet the besetting sins of the age are those due to a lack of moral fibre. Moral qualities are the most susceptible of modification; moral interests give direction to all we do. Hence, the most important phase of education is moral education. How apt we are to concentrate all our attention and all our energies upon a few facts of arithmetic and geography and entirely neglect the implantation of great moral ideals!

Individuality and Education.—The foregoing discussion must not be construed as an argument against education. It is a strong plea for the wisest education possible. An analysis of education from the stand-point of heredity discloses its possibilities as well as its limitations. No two children possess abilities equal in kind or degree. It is a false doctrine of education which assumes that they do. The better recognition of individual capacities and differences is one of the most pressing demands of education. Children have been treated in masses too long. The education must be made to fit the child and not the child the educational system. A study of the family history and hereditary tendencies will assist greatly in discovering capacities and in determining the best means and methods of education for individual cases.

In arguing as above one is quite sure to meet incredulous persons who are certain to mention stories of great men and women who are said to have sprung into prominence from the weakest, most worthless, and most profligate ancestry. Pin such

a person down and he will fail to prove a single case of the sort. True, many of the world's illustrious have had humble parentage and have sprung from apparent obscurity. But a study of family history will always reveal intellectual greatness somewhere in the line of descent—and not very remote. Holmes well says that it takes three generations to make a gentleman, and it takes many more than three times three to make an intellectual giant. Many of the giant intellects of the world have not been illustrious. They may have lived in poverty and obscurity, unstimulated by any great cause which enlisted their enthusiasm and brought to light their greatness.

Obscurity must not be confused with inferiority. But for chance circumstances many of the most illustrious names of history would have been unknown. With different environment at the opportune time, thousands of obscure names might have been emblazoned on the pages of history. Remember the poet's expression:

> "Full many a gem of purest ray serene
> The dark unfathomed caves of ocean bear,
> Full many a flower is born to blush unseen
> And waste its sweetness on the desert air."

Sometimes there is an alternation of generations, and qualities which make for intellectual greatness seem to lie dormant, and again intermarriages change the whole current of growth. It is possible for intellectual cultivation to be pursued so continuously and so tensely that physical vitality is undermined. Nature then demands a rotation in order to recuperate the depleted treasury. There is grave danger that modern civilizations are too exclusively intellectual at the expense of physical vigor. With the sudden abandonment of manual labor and a dependence upon wits, it is very probable that intellectual development is proceeding at a pace which cannot be supported by the degenerating bodies. Evidence is easy to mass from the facts that lawyers, doctors, ministers, teachers, kings of finance, and others who live by brain alone do not leave enough children to keep up the average of population, and these children with

hypersensitized devitalized bodies. The tillers of the soil, the street laborers, and the dwellers in the slums, who survive by sheer muscular force, are the ones who are peopling the earth, and their children must as certainly possess it.

These are not arguments against intellectual education, but rather for a proper balance between mental and physical culture. A revival of the Greek ideal of harmony between the two, with our superior knowledge of the means of attaining the two, would speedily put mankind ahead so far that future generations would regard the present as exceedingly primitive.

Discovery and Ministration.—Though education cannot greatly modify capacity, it can discover powers; it can minister to them; it can develop to their utmost those that are potential. In these respects our educational methods have been wofully at fault. By insisting that the business of education is to create power, great possibilities have been neglected. Discovery, stimulation, ministration, and development offer unlimited fields of opportunity for work in education. It is seldom that an individual has developed in any direction to his greatest capacity. It is seldom that one has been studied by his guardians—parents and teachers—so that they know his possibilities and his limitations. Still less frequently has the study been of such a character as to become a means of self-revelation to the individual. Too often the emphasis in his education has been placed on the attempt to "round out" in harmony with some misconceived ideal. In the "rounding-out process" little progress has been made and meanwhile hidden talents have remained undiscovered, allowed to atrophy and decay, or even worse, to be ruthlessly snubbed or uprooted.

What gardeners would set up an artificial ideal of "all-roundness" in horticulture and try to make all plants grow of the same height, the same thickness, the same greenness, the same juiciness, the same flavor, or the same odor? No, we must have trees and shrubs and vines; creepers and climbers; oaks and squashes; apples and thistles. And even among apples we must have the crabapples, the Baldwins, the Duchesses, and the Tallman

Sweets. Similarly among men, we must have the black, the yellow, the copper, and the white; blonde and brunette; blue-eyed and black; the tall and slim, and the short and thick-set; the musical, the mathematical, and the artistic; the choleric and the phlegmatic; the farmer, the merchant, the lawyer, the doctor, the laborer, and the inventor; the soldier and the statesman; and thousands of others, each filling his niche and necessary to the welfare, happiness, and progress of all the others.

Heredity and Race Education.—To all who have a broad educational vision and who are concerned for the welfare of the race as well as for the individual, the study of heredity should extend much hope. Education becomes a race question. Heredity is the great conservator of all life forces. Every effect produced in the individual is preserved and effects are cumulative. To be sure, this is not encouraging to the one who wastes his substance in riotous living. But we sin against such a one in giving him comfort and assurances of a final happy outcome, regardless of his life. He will rise up and call us blessed if we sternly impress upon him the inexorableness of nature's laws. He must be shown that he cannot overdraw his bank account *ad libitum.* The day of reckoning is a certainty, and nature is an errorless book-keeper. She cannot be cheated. The account is absolutely correct. With the same unerring accuracy nature keeps the account of the righteous man. What he saves is not only kept inviolate, but it is sure to pay compound interest in the form of health, strength, and character.

Similarly with the race the question of progress or retrogression is simply figured out by that arch banker, nature. If all individuals of the race could only wisely keep their balance on the right side of the ledger, what tremendous reserves and dividends we should soon have to be used for new enterprises and conquests! We know this to be true in developing plants and animals, but how prodigal in the case of mankind! Galton says: "I argue that, as a new race can be raised to so great a degree of purity that it will maintain itself, with moderate care in preventing the more faulty members of the flock from breed-

ing, so a race of gifted men might be obtained under exactly similar conditions." For long years Galton has pondered this great question. As a result of his thinking a new science is being discovered—that of eugenics. The University of London has established the "Francis Galton Laboratory for National Eugenics." From that laboratory there will soon be published a *Treasury of Human Inheritance*, which will contain family histories illustrating various types of heredity, such as, intellectual ability, tuberculous stocks, epileptic tendencies, physical depravity, etc.[1]

[1] For literature on eugenics consult: Galton, "Eugenics, Its Definition, Scope, and Aim," *Am. Jour. of Soc.*, 10: 1–6, 1904; Karl Pearson, *The Scope and Importance to the State of the Science of National Eugenics*, Oxford University Press; Pearson, *A First Study of the Statistics of Pulmonary Tuberculosis*, Delau & Co., 1907; Fisher, "Report on National Vitality," *Bulletin* 30 *of the Committee of One Hundred on National Health*, Government Printing Office, Washington, 1909; Saleeby, "The Psychology of Parenthood," *Eugenics Review*, April, 1909; Bateson, W., *The Methods and Scope of Eugenics*, Cambridge University Press, 1908; Saleeby, *Parenthood and Race Culture*, 1909.

CHAPTER X

CORRELATIONS BETWEEN MIND AND BODY

This is a subject which has not received adequate consideration in pedagogics. Some account has been taken of it in recent medical literature, but even there the importance attached to it has been slight compared with its merits. We are still too much under the domination of drugs and nostrums. In innumerable cases where drugs have brought relief, the cures in reality have been brought about by mental states. The only difference between such cures and those effected by drugless therapeutics is that with the majority of people the drugs are a necessary means in producing the desired mental beliefs.[1]

Influence of Mind Over Body.—If we reflect a little we shall realize that the mind exerts a most powerful influence over bodily states. We know that grief causes the face to become pallid, while joy produces heightened color. Love, shame, and anger bring blushes to the cheek. Grief and sorrow stimulate the lachrymal glands to action. The same emotional states produce retarded circulation, impaired digestion, and the entire body often suffers in efficiency. Joy and happiness, on the other hand, increase the heart action, the blood goes bounding on its way; respiration is deeper, the digestive organs are toned up and physical vigor is manifested in every bodily action.

The sight of food often causes the mouth to water. The thought of a disgusting sight may produce nausea and vomiting. A French physician, Dr. Durand, reported that he made experi-

[1] This chapter is not an endorsement of any so-called Christian Science or faith cures, although each of those makes use of the fundamental principles for which I shall contend. When one goes so far as to maintain that all disease is imaginary, that no disease is real, or that drugs cannot assist nature, or that thinking can replace a lost limb or reset a broken bone, the position becomes not only unscientific and unphilosophical, but absurd.

ments upon one hundred hospital patients by giving them drinks of sugared water and then pretending "to have made a mistake in inadvertently giving them an emetic, instead of syrup of gum. The result may easily be anticipated by those who can estimate the influence of the imagination. *No fewer than eighty*—four-fifths—were immediately sick. How many of the rest suffered from nausea is not stated." [1]

The salivary glands are profoundly affected by mental states, especially emotions. Every school-boy who has gone to the platform to declaim and who has felt any degree of stage fright, knows of the dryness of the mouth that in turn becomes a source of difficulty and embarrassment. The story of the ancient Hindoo method of discovery of thieves among suspected servants in a family has become a classic. Each offender was required to chew a quantity of rice for a few minutes. The one who had the driest mouthful was deemed the offender. The gastric fluid is so much affected by fear that its secretion may be entirely suspended. This has been noted among animals as well as in the case of man. Good cheer probably promotes the flow of the gastric juice, for the digestion is certainly aided by cheerful emotions.

Fear has a very great influence over the heart. We have the classic example of this in the story of the prisoner condemned to death by bleeding. He was placed in a chair, blindfolded, the *back* of a knife-blade drawn across the wrist and a little tepid water made to trickle over the wrist. A few tremors ensued and then he became quiet. The bandage was removed and the bystanders beheld a staring corpse. Fear had stopped all cardiac action.

Every-day experience demonstrates that actions of the body except those which are reflex and automatic are under control of the mind. In the discussion of volitions an attempt will be made to show that even many reflexes may have a mental origin. Anatomy shows that the stimuli from the outside world acting upon the senses in some way induce sensations, perceptions, feelings, and other mental states. In turn the different nerve

[1] Hack Tuke, *Influence of the Mind upon the Body*, p. 126.

currents which have excited mental changes are succeeded by efferent currents from the brain and other central ganglia which excite muscular action. Pathology has demonstrated that mental diseases are frequently due to brain diseases. Post-mortem examinations even show that frequently particular brain lesions are correlated with particular mental diseases. Any direct disturbance of the brain by means of vivisection or through accident usually produces mental aberration of some kind. Excision of different parts shows corresponding characteristic mental changes, as in the case of the removal of the cerebrum or the cerebellum of frogs and pigeons. Physical exercise in moderation promotes mental activity, a good supply of oxygen is the best mental tonic, while excessive physical exercise producing fatigue has a depressing mental effect. The effects of various drugs, such as opiates, stimulants, and narcotics, are well known. Thousands are yearly made mental wrecks by dosing their bodies with opium, chloral, or alcoholic stimulants. The cigarette fiend among our schoolboys is not only dwarfed in body, but his mind suffers even a worse fate. Some sicknesses, such as fevers and neurasthenia, cause a great variety of mental affections. Blows received on the head or other parts of the body frequently cause unconsciousness. Bodily death means cessation of mental activities. Psychologists have demonstrated that when imagining any thing precisely the same centres are innervated as when perceiving the same thing. Crook the finger and think hard of pulling the trigger of a pistol and fatigue will ensue as if the action had really been performed. Imagined activity in dreams is often more fatiguing than the reality in waking hours. Excessive day-dreaming is as exhausting as genuine work. The imagined states in certain pathological processes are especially debilitating. It is said that medical students studying the heart and directing their thoughts to it frequently suffer from its disturbed action. The eminent surgeon, John Hunter, is quoted by Tuke as saying: "I am confident that I can fix my attention to any part until I have a sensation in that part." Suppose a person is told that there is

an ant or a big worm crawling upon the back of his neck. If the statement is believed, in many cases the ant or worm will be felt, though not there. The writer once suggested to a popular audience that they think intently that ants were on their necks. So vividly did one woman experience the sensation suggested that she went into hysterics.

So decidedly do vivid imaginations of a given state affect some persons that they often sympathetically suffer precisely as others whose sufferings they witness. Personally I have suffered acutely from a given pain when witnessing others in agony from the same. Tuke cites the following case related by Quain at the Westminster Medical Society: "A gentleman who had constantly witnessed the sufferings of a friend afflicted with stricture of the œsophagus, had so great an impression made on his nervous system, that after some time he experienced a similar difficulty of swallowing, and ultimately died of the spasmodic impediment produced by merely thinking of another's pain." [1]

Fear exerts a profound influence upon all the organs of the body, causing the knees to shake, the hand to tremble as with palsy, the tongue to cleave to the roof of the mouth, the lips to move as in pantomime, the eyes to stare as if starting from their sockets, the face to blanch and its muscles to twitch, the heart to thump, to flutter, or to cease action. It may even produce complete syncope.

Anger affects the body so decidedly that often control is completely lost. Heart failure is a frequent effect of uncontrollable anger. The eminent surgeon John Hunter was a constant sufferer from the effects of emotional excitement. In relating an affecting story his articulation was always much disturbed. He used to say: "My life is at the mercy of any scoundrel who chooses to put me in a passion." His words proved prophetic, for when arguing before a hospital board for a certain measure he made some remarks which were contradicted by a colleague: "Hunter immediately ceased speaking, retired from the table, and struggling to suppress the tumult of his

[1] Tuke, *Op. cit.*, p. 126.

passion, hurried into an adjoining room, which he had scarcely reached, when with a deep groan, he fell lifeless." [1]

Joy may affect the heart as seriously as fright or grief. History records that the old doorkeeper of Congress died on hearing the joyful news of the surrender of Cornwallis. Tuke even remarks that: "If we take two persons and subject one to the operation of a depressing, the other to that of an exciting emotion, the former may remain calm and the latter faint away. Yet, in many instances, such is the actual result. Lord Eglinton informed John Hunter that when two soldiers were condemned to be shot, but one was to receive a pardon, the event being decided by their throwing dice, the one who proved successful—thus procuring a reprieve—generally *fainted*, while the one to be shot remained calm."

A veterinary surgeon was about to be operated upon. He was not a nervous person and went to the operating-room calmly and without apparent fear, but at the moment of beginning the operation he turned pale, fainted, and in ten minutes was dead. The result was plainly due to shock from the apprehension concerning the result.[2] Cases are recorded in which the patient faints on seeing the surgeon. Undoubtedly thousands of persons have died of fright as a result of practical jokes. The newspapers and medical journals abound in well-authenticated cases. Tuke relates the case of a man condemned to die by the headsman's axe. His head was placed upon the block and the executioner prepared to strike the fateful blow. A tumult outside caused a cessation; a reprieve had come. They turned to communicate the joyful news to the doomed man. Alas! his spirit had flown. Fright had become his executioner.

It is popularly believed that fright blanches the hair. Byron wrote of the Prisoner of Chillon:

> "His hair was white but not with years,
> Nor grew it white in a single night,
> As men's have grown from sudden fears."

[1] Tuke, *loc. cit.*, p. 270.

[2] *The Medical Times and Gazette*, July 28, 1866.

From another source:

> "For deadly fear can Time outgo,
> And blanch at once the hair."

No doubt the popular belief finds support in pathological records. Montesquieu tells us that his own hair became gray in a single night on receiving distressing news concerning his son. Marie Antoinette is said to have become gray in her last agony. So great an effect is possible that continued anxiety of mind may cause the hair to fall.

Undoubtedly many of the diseases of human life are purely imaginary. Quacks, charlatans, and vendors of patent medicines thrive from the traffic in cure-all medicines advertised conspicuously before a gullible public. Unsophisticated persons and those with disordered imaginations read the descriptions of symptoms and forthwith begin to picture those states in themselves. The nostrums, mainly alcoholic preservatives, frequently effect "cures" through the help of the imagination. Such persons remain improved or cured until a new set of symptoms is suggested to them, when they resort again to the six bottles for five dollars or the hundred doses for a dollar. Not seldom do the frequent dosings induce real diseases.

It is especially true that when coupled with grief imaginary diseases make serious inroads upon the health. Many people nurse their griefs and other ailments until their constitutions are undermined. I believe that many cases of insanity are directly traceable to excessive nursing of grief. Every one is in a large measure responsible for his sanity or insanity of mind. An effort to keep the mind filled with wholesome, uplifting thoughts brings its own reward no less definite than when morbid ideas are harbored.

Münsterberg Quoted.—"That mind and body come in contact," says Münsterberg, "is a conviction which goes with every single sense-perception. I see and hear because light and sound stimulate my sense-organs, and the sense-organs stimulate my brain. . . . In the same way it seems a matter of course that

mind and body are connected wherever an action is performed. I have the will to grasp for the book before me, and obediently my arm performs the movement; the muscles contract themselves, the whole physical apparatus comes into motion through the preceding mental fact. . . . But it is not only the impression of outer stimuli and the expression of inner thoughts in which mind and body come together. Daily life teaches us, for instance, how our mental states are dependent upon most various bodily influences. If the temperature of the blood is raised in fever, the mental processes may go over into far-reaching confusion; if hashish is smoked, the mind wanders to paradise, and a few glasses of wine may give a new mental optimism and exuberance; a cup of tea may make us sociable, a dose of bromide may annihilate the irritation of our mind, and when we inhale ether, the whole content of consciousness fades away. In every one of these cases the body received the chemical substance, the blood absorbed and carried it to the brain, and the change in the brain was accompanied by a change in the mental behavior. Even ordinary sleep at night presents itself surely as a bodily state—the fatigued brain cells demand their rest, and yet at the same time the whole mental life becomes entirely changed. It is not difficult to carry over such observations of daily life to the more exact studies of the psychological laboratory and to examine with the subtle means of the psychological experiment the mental variations which occur with changes of physical conditions. We might feel, without instruments, that our ideas pass on more easily after a few cups of strong coffee, but the laboratory may measure that with its exact methods, and study in thousandth parts of a second the quickening or retarding in the flow of ideas. Every subjective illusion being excluded, our electrical clocks, which measure the rapidity of mental action and of thought association, will show then beyond doubt how every change in the organism influences the processes of the mind. Bodily fatigue and indigestion, physical health and blood circulation, everything, influences our mental make-up. In the same way it is the laboratory experiment which shows by the

subtlest means that every mental state produces bodily effects where we ordinarily ignore them. As soon as we apply the equipment of the psychological workshop, it is easy to show that even the slightest feeling may have its influence on the pulse and the respiration, on the blood circulation and on the glands; or, that our thoughts give impulse to our muscles and move our organs when we ourselves are entirely unaware of it." [1]

Psycho-Physical Parallelism.—The doctrine of psycho-physical parallelism maintains that all mental processes have concomitant physical processes. It is not asserted that the physical life is the cause; rather the accompaniment or concomitant. The question of causal relations is purposely avoided. It is not necessary to consider it in psychology any more than it is in physics. We may say that two physical changes, as the striking of the bell by a hammer and the sound emitted, are concomitants of each other, without becoming involved in the endless and futile speculation as to causal relations. Similarly we may discuss concomitant mental and physical phenomena without placing upon ourselves any obligations to discuss the problem of causality. The doctrine of psycho-physical parallelism has been summed up in the sentence: "There is no psychosis without neurosis."

We do not know, for instance, how light produces chemical changes, or, in fact, how any chemical changes are produced. But we know that the changes are produced and are willing to trace the sequential relations as far as possible and not become impatient if the exact way the change occurs is unexplained. In plant physiology we trace out the life-processes like the circulation of the sap, the division of cellular structures and the reproduction of new cells, the absorption of water and mineral foods in solution, the exhalation of oxygen through the stomata; we

[1] Münsterberg, *Psychotherapy*, pp. 34–36.

Note.—My own manuscript on the chapter on "Correlations Between Mind and Body" was written (though unpublished) at least three years before Münsterberg's above-mentioned book appeared. I take great pleasure in quoting liberally some confirmatory passages from Münsterberg's book.—The Author.

watch the formation of flowers, their fertilization and their change into fruit, and we say "how wonderful is life!" We do not say, "Now, Mr. Biologist, you must tell me what life is, or how sunshine and air are changed into plant tissue, or we shall discredit the whole explanation."

Similarly in the study of mental life: though we cannot tell how a wave of light or of sound excites an idea, yet we know that a correlation exists between them, and it is the province of the psychologist to study this sequential relation. It is absolutely futile to attempt to study the phenomena of mind without studying at the same time its bodily concomitants. It is still more barren of results to try to study means of mental development and culture without considering the physical conditions most conducive to the production of the desired mental life. Child-study and physiological psychology have ushered in a new era in educational science.

Spencer says: "No thought, no feeling, is ever manifested save as a result of a physical force. This principle will before long be a scientific commonplace." "That all of the psychic changes are accompanied by the display of energy in some form of material change in the nervous structures, is the most striking and far-reaching conclusion of modern psychology. . . . The general data of biology go to show that no physical change can take place in a living animal without directly or indirectly affecting the psychical condition of the animal. The psychical change may follow immediately as a sensation, and may remain as a new association in memory, or it may be a subconscious nervous co-ordination; or again the psychical change may be only a gradual change of the state of feeling, increasing or decreasing the vitality or general nervous activity of the animal." [1] To consider them as concomitants is not to subscribe to any doctrine of materialism or to maintain that man is an automaton or a machine. When I assert that a ray of light stimulated the retina giving rise to a nervous impulse that traversed the optic nerve, in turn producing cerebral changes, which signs were

[1] Orr, *A Theory of Development and Heredity*, p. 83.

translated into knowledge of the flowers or trees, I am not maintaining that knowledge begins with brain motion and ends there. I am not saying that the brain is a machine for converting sunlight into thought. Not at all. I still assume the existence of a mind which is able to use this material means and the exhibition of potentialities which I in no wise attempt to explain. But I do know that when I examine into the workings of mind, in order to understand as much as possible I must examine the concomitant nervous processes. Further, if I wish to secure given mental results in myself or in others, I must heed the correlative physiological laws. If I work too far into the night, my brain becomes fagged and my ideas will not develop. I must recognize that in all mental work I develop my impressions through bodily means and that I must employ bodily means (hand, tongue, etc.) in order to give them expression. This is one of the most important lessons that a leader of children could learn.

Dr. Carpenter has put it: "So long as either the mental or the bodily part of man's nature is studied *to the exclusion* of the other, it seems to the writer that no real progress can be made in psychological science [I should add, or in educational science]; for that which 'God hath joined together,' it must be vain for man to try to put asunder."[1]

Brain Size and Intelligence.—Various popular notions prevail respecting the relation between brain size and mental ability. Some suppose that there is a definite measurable relation between the size (weight) of brains and intelligence; others consider that there is absolutely no relation. Recent researches by careful neurologists tend to make one very conservative upon this topic. So many individual variations occur that definite assertions should be made with caution. While it is found that the brain of Cuvier the great naturalist weighed 1,830 grams and that of Abercrombie the celebrated physician weighed 1,785 grams, yet it is recorded that the brain of Liebig the illustrious chemist weighed only 1,352 grams, that of Whewell the renowned philosopher 1,390 grams, and that of Tiedemann the celebrated

[1] *Mental Physiology*, p. 2.

anatomist only 1,254 grams. It is not at all uncommon to find laboring men of very moderate intelligence with a brain weight of 1,500 grams or more. Thus, while it is true that we should find more very small brains among persons of low intelligence, and more very large brains among persons of a high order of intelligence, than vice versa, yet it would be unsafe to say that size of brain and intelligence are invariably correlated with each other. Donaldson[1] says: "While the heaviest brain-weights belong to the European races and the lightest to the Australians, thus giving a moderately wide difference in the weight of the brain corresponding to a wide difference in culture, yet it is quite impossible even in such a condensed series to harmonize the intermediate groups with the theory that brain-weight and culture, as we measure it, are closely correlated."

In a comparative table Donaldson shows that the average brain-weight of European females is a little less than that of Australian males, and remarks that, "the inference from brain-weight directly to intelligence is not a happy one." His final conclusion is that the result of recent investigations concerning the correlation of these two qualities "contributes mainly to a healthy scepticism concerning the current interpretation of brain-weight."

Still more positive statements are current with reference to the correlation between the convolutions of the brain and intelligence than concerning size and intelligence. Almost every school physiology has contained statements which have led the boys and girls almost invariably to rattle off parrot-fashion that the more convoluted the surface of the brain the greater the intelligence of its possessor. The statement is made that the higher in the scale of animal life, the more convolutions appear in the brain. Donaldson is authority for the statement that: "The significance of fissuration as an index of intelligence receives no support from comparative anatomy, since the brains of ruminants are much more convoluted than those of the dog, while the heavier and more intelligent birds have brains that are nearly

[1] *Growth of the Brain*, p. 120.

smooth." [1] The researches go to show that no constant relation obtains between fissuration and intelligence. Certain schools have maintained that the brains of criminals are differently fissured from those of normal individuals. Donaldson denies this, although he says that since the fœtal brain is smooth, early disturbances of its growth are forerunners of abnormalities of fissures later in life, and these abnormalities of structure are usually accompanied by mental abnormalities. It has also been maintained that the brains of males have deeper fissures than the brains of females. Although it is generally agreed that the male brain tends to be more extensively fissured, yet "there are no characters by which the sex of a given brain can be recognized with certainty." [2]

It should be conceded, however, that although within a given class the variations in fissuration are not great enough to warrant positive declarations concerning the direct relation between convolutions and intelligence, yet the different classes of animals are distinctly different in this respect. It should also be stated that the more highly civilized races have somewhat heavier brains than the uncivilized races. Bastian [3] confirms this general position. He records observations showing that the average weight of several Europeans' brains was 1,390 grams, while the average weight of a number of negroes' brains was 1,255 grams. Many more cases need to be recorded in order to gain more accurate data. Great care should also be taken to study the different tissues to see whether the gross weight comes from genuine brain matter or from other tissues which may make up the bulk.

It is also to be noted that the majority of idiots have very small brains. Cases have been found where an idiot's brain weighed only 241 grams. It is doubtful whether any congenital idiots have brains of normal size and weight. Insane persons are too often classed as idiots, but this is absolutely erroneous, as an insane person is one who lacks balance and is not necessarily

[1] *Op. cit.*, p. 201. [2] *Op. cit.*, p. 200.

[3] *The Brain as an Organ of Mind*, chap. 20.

devoid of intelligence. Some persons become imbecile through disease and these should not be classed with congenital idiots. Bastian writes:[1] "Where the weight of the brain falls below a certain minimum standard, the possession by its owner of anything like ordinary human intelligence seems to be impossible. Gratiolet, without specifying the sex, supposed this lower limit of weight to be about 31¾ ounces, or 900 grams. Broca places it somewhat higher, fixing upon 32 ounces, or 907 grams, as the limit for the female, and 37 ounces, or 1,049 grams, as the lower limit of weight for the male brain, compatible with ordinary human intelligence."

Carpenter says:[2] "There is, however, a marked diversity in respect of size between the brains of different races of men; those of the most civilized stocks, whose powers have been cultivated and improved by education through a long series of generations, being for the most part considerably larger than those of savage tribes, or of the least advanced among our own peasantry. So far as can be judged from the few cases which have furnished adequate materials for the determination, the brains of those earliest races of men, which (like the old 'flint-folk') had made but a very slight advance in the arts of life, were extremely small."

Spencer, Fiske, and Romanes have shown that in general there is a close correspondence between intelligence and the possession of organs capable of varied muscular activities. Brain bulk alone does not tell the story of intelligence, but the possession of a nervous mechanism so highly specialized as to give co-ordination of a great variety of actions is even more significant. Complexity of structure is more significant than mass. The extent of convoluted surface, and the number and complexity of the lobes growing from the brain-stem are good indexes of intelligence. Romanes[3] quotes Dujardin, who says that in the case of ants "the degree of intelligence exhibited stands in an inverse proportion to the amount of cortical sub-

[1] *Op. cit.*, p. 364. [2] *Mental Physiology*, p. 95.
[3] *Mental Evolution in Animals*, p. 46.

stance, or in direct proportion to the amount of the peduncular bodies and tubercles."

Psychological and Zoological Scale Compared.—An examination of the brains of extinct species shows that their cerebral lobes were much smaller than in present closely related species. Prof. E. Ray Lankester, who probably first drew attention to the fact and its significance, wrote the following:[1] "It is well established that the extinct mammalia of the middle and lower tertiaries had—as compared with their nearest living congeners—an extremely small cerebrum. The exact figures are not important, but titanotherium—a true rhinoceros—had certainly not more than one-fifth of the cerebral nervous substance which is possessed by the living rhinoceros. Dinoceras, representing a distinct group of ungulata, had even a smaller brain. Yet in bulk these animals were as large as, or larger than, the largest living rhinoceros."

Now what is the significance of the increase of the proportional cerebral development? The added size is not necessary for physical control. The lower centres furnish this in abundance. Many of the lowliest animals control the movements of the muscles much more skilfully than man can possibly do. Any one would be quite content to run as swiftly as a dog, to jump as far and as dexterously as a cat, or to approximate the agility of the lion or monkey. In fact, the intellectual giant is often the muscular pigmy, and the clown in movement. Since the dawn of mind development has been turned in directions more useful than the maintenance of muscular strength and skill.

"Man is born with fewer ready-made tricks of the nerve-centres—those performances of an inherited nervous mechanism so often called by the ill-defined term 'instincts'—than are the monkeys or any other animal. Correlated with this absence of inherited ready-made mechanism, man has a greater capacity for developing *in the course of his individual growth* similar nervous mechanisms . . . than any other animal. He has a greater capacity for 'learning' and storing his *individual*

[1] *Nature*, 61 : 624, April 26, 1900.

experience, so as to take the place of the more *general* inherited brain mechanisms of lower mammals. Obviously such brain mechanisms as the individual thus develops (habits, judgments, etc.) are of greater value in the struggle for existence than are the less specially-fitted instinctive inborn mechanisms of a race, species or genus. The power of being educated—'educability' —as we may term it—is what man possesses in excess as compared with the apes. I think we are justified in forming the hypothesis that it is this 'educability' which is the correlative of the increased size of the cerebrum." [1]

TABLE SHOWING RELATION BETWEEN BRAIN-WEIGHT AND BODY-WEIGHT, AND OF BRAIN TO WHOLE NERVOUS SYSTEM. [2]

CLASSES	BRAIN TO BODY	BRAIN TO NERVOUS SYSTEM
Fishes	1 : 1,000	$1:7=\frac{1}{7}$
Reptiles	1 : 1,000	$1:5=\frac{1}{5}$
Birds	1 : 100	5 : 1 = 5 times
Mammals	1 : 200	3 : 1 = 3 times
Man	1 : 50	30 : 1 = 30 times

While there is an apparent justification for assuming that the higher in the zoological scale the higher the mental order, yet there are many notable exceptions. We find also that the zoological classification will not answer for a scale based on mentality. It is a fact that small animals have larger brains proportionately than large animals. Some of the smallest birds have larger brains proportionately than man. A table showing brain-weight compared with body-weight would place the sheep higher than the elephant. Whoever knows the stupidity of the former and the sagacity of the latter can contradict that.

Of more significance than size is the proportional amount of gray and white matter. The gray matter being the generator of nervous force and the white the transmitter, it is obvious that

[1] E. Ray Lankester, *Nature*, 61 : 624.

[2] Le Conte, *Comparative Physiology and Morphology of Animals*, p. 73.

gray matter is the better index of organization. In the ascending scale of life we find that there is a larger and larger proportion of gray matter. Correlated with this in a general way we find that the greater the proportion of gray matter the more numerous the convolutions of the brain affording surface for it. All animals below the mammals have smooth brains. In general, the higher the class psychically the more convoluted the brain surface. Man has the most convoluted brain of all the animals. There are certain variations in the general relations, however, that should be noted. It is not so necessary for small brains as for large ones to be convoluted. A small brain has relatively more surface than a large one, because the surfaces of solids vary with the square of the diameters, while bulk varies as the cube of the diameters. Thus all large animals have convoluted brains while all small ones have smooth ones.

The most significant visible feature, however, is the size of the cerebral lobe. A most cursory examination of a series of brains shows an ever-increasing amount of cerebral surface as the zoological scale ascends. No other feature is so indicative of the grade of intelligence. Each succeeding order has a larger proportion of cerebral matter, and the higher the species within the order zoologically, the better developed the cerebrum. There is no doubt also that cerebral development is closely correlated with intelligence. The control of deliberative thought and all higher psychoses is a function of the cerebrum. The most striking difference between the brain of a man and an ape is in the degree of cerebral development. This is easily inferred by comparing a series of brains with the character of mental life exhibited by those classes of animals represented. Even a tyro would arrive at this inference. Experiments and observations made possible through accidental lesions and through purposive brain surgery all tend to confirm the empirical opinion that the frontal lobes are the seat of the higher mental life. In examining a series of brains from fishes to man the feature which shows steady progress is that of the cerebrum. All the features except the cerebrum are practically as large and as well developed in

many of the lower animals as in man. In some cases, for example, the olfactory lobes in dogs, cats, and other animals, are much in excess. The frontal lobes are plainly of no advantage in merely controlling the vital processes, for what animal is so fragile as man? It is only after long generations of medical skill that it is possible to bring more than one-half of the human race to maturity, while lower animals seldom die of disease. Cerebral development does not minister to skill in muscular movement. Who does not envy the animals their power of locomotion and marvellous strength and speed? In definite instinctive endowment, again, man is inferior to lower animals. The lower centres control reflex and instinctive movements. They are also the centres which conserve all automatic processes and habits involving muscular movements.

The highly developed frontal lobes are certainly the physiological structures which have made possible a high degree of education in man. No animal devoid of this development can plan deliberate action or make much use of experiences in the interpretation and mastery of new situations. Though they accomplish many instinctive automatic actions with wonderful precision and rapidity, they benefit little by experience and succeeding generations execute the same actions and in the same practically unchanged manner. Therefore we may conclude that highly developed cerebral lobes are an index of educability. In idiots and persons of a low order of mentality this portion of the brain is usually poorly developed. Conversely Carpenter says[1] that "where the cerebrum is so imperfectly developed as to be greatly under the average size, there is a marked deficiency in intelligence, amounting to absolute idiocy."

The weight, size, and general configuration of the nervous system are good indexes of the scale of life occupied, but within a given species undoubtedly the quality of the tissues themselves is more determinative of the rank which the individual is to occupy. Scales, microscopes, and chemical reagents have thus far failed to reveal just what those structural differences may be;

[1] *Mental Physiology*, p. 97.

but that such exist can scarcely be doubted. We all know that mere size and form of muscles are not absolute indexes of strength. Frequently a small individual is both actually stronger and has a greater vital capacity than much larger ones. So it is with brains. Quality as well as quantity and proportion must be taken into account.

James wrote in this connection:[1] "All nervous centres have then, in the first instance, one essential function, that of 'intelligent action.' They feel, prefer one thing to another, and have 'ends.' Like all the organs, however, they *evolve* from ancestor to descendant, and their evolution takes two directions, the lower centres passing downward into more unhesitating automatism, and the higher ones upward into larger intellectuality. Thus it may happen that those functions which can safely grow uniform and fatal become least accompanied by mind, and that their organ, the spinal cord, becomes a more and more soulless machine; whilst on the contrary those functions which it benefits the animal to have adapted to delicate environing variations pass more and more to the hemispheres, whose anatomical structure and attendant consciousness grow more and more elaborate as zoological evolution proceeds. In this way it might come about that in man and the monkeys the basal ganglia should do fewer things by themselves than they can do in dogs, fewer in dogs than in rabbits, fewer in rabbits than in hawks, fewer in hawks than in pigeons, fewer in pigeons than in frogs, fewer in frogs than in fishes, and that the hemispheres should correspondingly do more. This passage of functions forward to the ever enlarging hemispheres would be itself one of the evolutive changes, to be explained like the development of the hemispheres themselves, either by fortunate variation or by inherited effects of use. The reflexes, on this view, upon which the education of our human hemispheres depends, would not be due to the basal ganglia alone. They would be tendencies in the hemispheres themselves, modifiable by education, unlike the reflexes of the medulla oblongata, pons, optic lobes and spinal cord."

[1] *Principles of Psychology*, I, p. 79.

Le Conte writes:[1] "In the process of development, whether in the evolution series, or in the taxonomic series, or in the embryonic series, we observe the same order. Organisms are at first unmodified cell-aggregates. From such aggregates tissues performing different functions are differentiated. From this time onward cephalization begins. Among the tissues there is a gradually increasing dominance of the highest, . . . the *nervous tissue*. Then, *in the nervous tissue* a gradually increasing dominance of the highest part, viz., *the brain*. Then, *in the brain* a gradually increasing dominance of the highest ganglion, viz., the *cerebrum*. Then, *in the cerebrum* a gradually increasing dominance of the highest substance, the surface *gray matter*, as shown by the complexity of the convolutions. And, lastly, *among the convolutions* a gradually increasing dominance of the highest, viz., those in the frontal lobe, as shown by the position of the fissure of Rolando. In all there is an increasing dominance of the higher over the lower, and of the highest over all. This is everywhere the law of evolution." As Gaskell has said: "The law for the whole animal kingdom is the same as for the individual. Success in this world depends upon brains."[2]

Psychotherapeutics.—As diseases are induced and aggravated by the imagination, conversely the alleviation and the cure of disease are much dependent upon the imagination. It is unscientific to assert that all disease is purely imaginary or that there is no disease. Unfortunately the world is altogether too full of suffering and disease. But we should not lose sight of the well-established laws of mental and bodily interaction and should utilize this knowledge in every possible manner. Every good physician consciously or unconsciously does this. What success would a physician have if every time he entered the sick-room he remarked in the following fashion: "This is the worst case I ever knew; much like one I had last week that proved fatal." But how much the patient is aided by a cheery "Good

[1] *Comparative Physiology and Morphology of Animals*, p. 83.

[2] *The Origin of Vertebrates*. See also E. H. Starling, "The Physiological Basis of Success," *Science*, N. S., vol. XXX, September 24, 1909, pp. 389–401.

morning! You're progressing finely." Physicians have reported to me that in many cases harmless pills or colored H_2O are just as effective as anything else. The case of a young woman who had been bedridden for years was told me by one who compounded some medicines prescribed for her relief. She had tried every physician accessible and every remedy known to them. Finally a new doctor came to the town. He asked to be given the case, saying that he had a new remedy which had proved absolutely efficacious in similar cases. He was given the case, and inside of a month the young lady was entirely restored. He afterward said that the medicine consisted absolutely of pure water and a little coloring matter.

Sir Crichton Browne [1] wrote: "The success or failure of a practitioner will often depend as much on experience as a medical psychologist as on skill in simples." Schofield [2] said that: "Dr. Rush never prescribed remedies of a doubtful efficacy in the various stages of acute disease till he 'had worked up his patients with a confidence bordering on certainty of their probable good effects. The success of this measure has much oftener answered than disappointed my expectation.' . . . In neglecting the systematic and scientific employment of mental influence in the course of disease, medical practitioners throw aside a weapon for combating it, more powerful than all the drugs in the Pharmacopœia."

Sir Thomas Grainger Stewart is quoted by Dr. A. Morrison [3] as saying: "In heart disease the most important element is rest. Second in importance is perhaps the element of hope. If a patient becomes persuaded that he may recover, that good compensation may be established, he becomes more hopeful about himself and his heart benefits correspondingly. If a patient is gloomy and despondent, this damages the organ in a way we cannot at present fully explain."

Maudsley [4] has expressed a strong belief in the influence of mental therapeutics in the cure of disease. He wrote: "Per-

[1] *British Medical Journal*, 1889, 2 : 400.
[2] *Unconscious Mind*, p. 375.
[3] *Practitioner*, 1892, p. 29.
[4] *Body and Mind*, p. 39.

haps we do not, as physicians, consider sufficiently the influence of mental states in the production of disease, and their importance as symptoms, or take all the advantage which we might take of them in our efforts to cure it. Quackery seems to have here got hold of a truth which legitimate medicine fails to appreciate and use adequately. Assuredly the most successful physician is he who, inspiring the greatest confidence in his remedies, strengthens and exalts the imagination of his patients; if he orders a few drops of peppermint-water with the confident air of curing the disease, does he not do more sometimes for the patient than one who treats him in the most approved scientific way, but without inspiring a conviction of his recovery?"

A new era is dawning in the utilization of psychological means in therapeutics. Too much quackery and charlatanism have characterized the attempts down to the present time and as a consequence the whole of psychology has been discredited and its applications to medicine have been feared. However, physicians and psychologists have begun to take up the matter in a serious way. Many physicians, without advertising the fact, are studying psychology and applying it in a helpful way in their practice. The most hopeful sign of its coming general recognition is in the fact that many medical colleges have already made psychology one of the required studies in the curriculum.[1] The appearance of such books as Münsterberg's *Psychotherapy* will do much to place the subject upon a scientific basis. Münsterberg says that: "Indeed the times seem ripe for a systematic introduction of psychological studies into every medical course. It is not a question of mental research in the psychological laboratory where advanced work is carried on, but a solid foundation in empirical psychology can be demanded of everyone. He ought to have as much psychology as he has had physiology. . . . The ideal demand would be that the future physician should spend at least a year of his undergraduate time on empirical psychology, especially on experimental and physiological psychology."

[1] The writer was appointed Lecturer on Psychology in the Milwaukee Medical College in 1900. Removal from the city soon after the appointment made it impossible to enter upon the work.

He writes further: "It must not be forgotten that mental factors may enter into every disease. The psychology of pain, for instance, and of comfort feeling, the psychology of hunger and thirst, of nausea and dizziness, the psychology of the sexual feelings, the psychology of hope and fear, of confidence and discouragement, of laziness and energy, of sincerity and cunningness, play their rôle in almost every sick-room. And if the physician haughtily declares that he does not care for the methods of suggestion, it might justly be asked whether he can be a physician at all if he does not apply some suggestions; yes, if his very entrance into the sick-room does not suggest relief and improvement from the start? The introduction of a serious study of psychology is the most immediate need of the medical curriculum. . . . Can the medical profession afford to send into the world every year thousands of young doctors who are unable to use some of the most effective tools of modern medicine, and tools which do not belong to the specialist but just to the average practitioner, simply because they have not learned any psychology?" [1]

Bearings upon Abnormal Pedagogy.—In educating those who are sub-normal or nervous it is important to understand the correlations between mind and body. Certain types of children may be saved much suffering by rational pedagogic treatment. For example, night terrors occur in children of neurotic, scrofulous, or anæmic types. The immediate causes may be overexcitement during the day from excessive play, fright, worry over examinations, indigestion, catarrh, ear trouble, diseases of the eyes which produce hallucinations, and hosts of others. Insanity is very closely connected with nervous conditions. There are the senile dementias occurring when the brain undergoes dissolution; those arising from brain lesions, clots in the brain, spinal injuries, and the like. Then there are also several special periods of life when the mind is peculiarly liable to become disordered. The age of puberty claims many victims. Clouston has made a special study of the neuroses and insanities of pubertal develop-

[1] *Psychotherapy*, pp. 364–366.

ment. Because of the unstable condition of mind and body at this time, overwork and worry are especially liable to produce insanities. Hereditary predispositions to insanity which have been latent but deferred will usually crop out in adolescence if ever. Several epochs in the life of women characterized by far-reaching physical changes are frequently the occasions for the development of hypochondria, melancholia, hysteria, suicidal manias, and various other mental disorders. "Observation of the phenomena of defective and disordered mind proves their essential dependence on defective and disordered brain. . . . The insane neurosis which the child inherits in consequence of its parent's insanity is as surely a defect of physical nature as is the epileptic neurosis to which it is so closely allied." [1]

Almost all forms of bodily disease may be the exciting causes of mental disorders. Hyslop[2] mentions such affections as indigestion, bad teeth, defective mastication, duodenal catarrh, functional perversions of the liver, spleen, or pancreas; peritonitis; diseases of the heart and circulatory organs, cardiac valvular lesions, phthisis, and many others. Idiocy, epilepsy, feeblemindedness, are probably always accompaniments of defective nervous development or physical malformations. Many criminologists declare that all criminals are fatally predisposed toward crime by physical defects. They claim that even outward measurements disclose marked atypical or malformed features. While they probably entirely overrate the direct correlation between bodily defects and moral delinquencies, yet there is a sufficient basis of truth to cause educators to suspect mental peculiarities if glaring physical defects are present.

Importance in Normal Pedagogy.—A knowledge of the intimate interrelations between mind and body is very important in the pedagogical treatment of normal children. All mental life is absolutely dependent upon bodily activity for expression. No thought can be revealed to others except through some physical manifestation. Every thought tends to issue in some form of motor activity and unless the motor phase is developed the

[1] Mandsley, *Body and Mind*, p. 68. [2] *Mental Physiology*, p. 510.

idea does not come to completeness. The body possesses all the gateways to the soul and no message can issue except through the medium of bodily expression. Consequently, how important that all the avenues of impression and expression be in absolutely the best possible working order. It is a tacit recognition of this interrelation which has caused so much attention to be given in recent years to testing the eyes and ears of school-children. It is recognized that poor work is frequently a result of sense-defects, often easily remedied.

The Doctrine of Innate Ideas.—The old doctrine of innate ideas, or even the doctrine which assumes the complete disparateness and independence of mind and body, when applied in educational practice made instruction a wordy process. According to the doctrine of innate ideas it was assumed that the individual had in his mind all the knowledge that he would ever possess. The function of the teacher was merely to develop ideas already in possession of the learner. The teacher, according to Socrates, was to be a midwife of ideas. Teaching was a science of *maieutics, i. e.*, a science of giving birth to ideas. Many teachers, though not professed disciples of the Socratic method, still proceed as if they believed the child could express ideas which he has never gained. They try to "develop" ideas which he does not possess. They try to pump water from the well when it is dry. Ideas cannot be "developed" until they have been gained, and in placing the child in possession of ideas it must be constantly borne in mind that the mind can never possess any knowledge whatsoever which has not been gained through sense-perception, either as a whole or in its elements.

The period of the reign of the doctrine of the innateness of ideas and of the belief in the complete independence of mind from body, may well be termed the dark ages. Men possessed eyes and they saw not. It was a deaf age, for they possessed ears and heard not. It was an age of anæsthesia, for they possessed touch and felt not. Rather than test the world of phenomena by means of their senses, they relied on tradition and superstition for their interpretation of the universe. Their ancestors had used

their senses and evolved theories, crude and childish to be sure, and in so doing had developed sense-organs with potentialities for using them. But the educated men of the Middle Ages had come to believe that all flesh is of the devil and that the body must be abased in order to elevate the spirit. Scholars shut themselves away from the world in monasteries, scourged the body and subjected it to tortures of every description. Instead of nourishing the body and giving it exuberance and vigor, they reduced its vitality and dulled the senses through fasting and long hours. By retirement within dingy walls they, so to speak, closed their ears and eyes, and all the other senses, to the knowledge and beauty of the world of phenomena all about them. Instead of drinking in new knowledge and inspiration, and subjecting the ideas of their ancestors to new tests and thus evolving new interpretations and new facts, blind and deaf and anæsthetic as they were, they merely copied, copied, copied, and passed on old traditions and old superstitions, which became more distorted as time passed. What wonder, then, that witchcraft and sorcery were believed in and that every method of torture that could be devised by disordered imaginations was visited upon the unschooled or upon those who had broken from their mural confines and through the evidence of their re-enthroned senses had gained a few independent ideas for themselves?

Middle-Age Asceticism.—The Middle-Age ascetics went so far as to assert that spiritual development could be best furthered by bodily torture. Consequently, in order to elevate the mind they strove to devise tortures to mortify the flesh. We read of their fasting, eating inappropriate foods, going barefooted and otherwise scantily clad in the dead of winter, wearing hair shirts with the hair inside, bathing in ice-cold springs in winter, sitting on sharp nails, assuming unnatural and extremely uncomfortable postures for months at a time, binding the body with weights, living in filth, going without sleep and working all day and all night, etc. St. Simeon Stylites lived for fifty years chained to the top of a high pillar, and St. Macarius slept for

months in a marsh exposing his naked body to the stings of venomous flies, in the misguided notion that the greater the bodily penance the more exalted the spirit became. In fact, they tried to devise every possible means of excruciating torture of body in the attempt to exalt the mind. To this pernicious doctrine of the relation between body and mind can be traced not only the long intellectual night of the Middle Ages, but also to it may be directly ascribed the belief in witchcraft, demonophobia, sorcery, and the superstition that insane people were possessed of evil spirits. Professor Monroe[1] says: "The virtue of the monk was often measured by his ingenuity in devising new and fantastic methods of mortifying the flesh. . . . All these forms of discipline were for the sake of the spiritual growth, the moral betterment of the penitent: all these, as the very significance of the word 'asceticism' indicates, reveal the dominant conception of education which prevailed throughout this long period,—the idea of discipline of the physical nature for the sake of growth in moral and spiritual power."

So long as the body was considered gross and evil and a mean tenement of clay from which the spirit should strive as soon as possible to escape, it was but natural that bodily care, and much less, culture, should be considered unworthy objects of education. With that prevailing view of the mind it was only natural that subjects of study in a curriculum were deemed unimportant in themselves but were regarded as "grindstones" upon which pupils were to sharpen their wits. Listen even to Montaigne, in many respects a pioneer of sense-realism in education, but who falls into the language of the time in discussing educational conceptions. He says: "That he may whet and sharpen his wits by rubbing them upon those of others, I would have a boy sent abroad very young." Rhabanus Maurus, an educator of the ninth century, reveals the ideal when he says: "Dialectic . . . is the queen of arts and sciences. In it reason dwells, and is manifested and developed. It is dialectic alone that can give knowledge and wisdom; it alone shows what and whence we

[1] *History of Education*, p. 248.

are, and teaches us our destiny; through it we learn to know good and evil."

Present-Day Renaissance.—Contrast the present rational theories with reference to means of securing mental results with those of the Middle Ages. It was not for lack of educational theory at that time that such pernicious practices in education abounded. It was rather because of absolutely false psychological theories. Ideas were thought to be innate. It was a late discovery, not yet wholly accepted in theory, much less in practice, that all knowledge takes its rise in the senses. Body and spirit were considered at war with each other. The whole object of life was to debase the body and to exalt the spirit. Hence the monastic torture and crucifixion of the body, in the thought, sincerely believed, that the spirit was being ennobled and fitted for the much-wished-for time when it could free itself of the body. No more significant educational era has ever dawned than the present, and one of the most important features is the just recognition of the importance of properly cherishing the physical temple of the soul. The renaissance of bodily adoration will be writ down in educational history as marking the most important mile-post down to the present. Not to neglect the inhabitant of this temple in our rush for physical culture, not to apotheosize mere brute force is the only caution that needs to be suggested. Hence, in any proper consideration of psychology or educational processes it is absolutely impossible to divorce the bodily and mental processes.

Because of the growing recognition of the intimate relation between mind and body very great changes have been brought about in the conditions under which the education of children is given. Better school buildings are being provided and due attention is being devoted to sanitation, including heating, lighting, ventilation, plumbing, seating, arrangement of corridors, minimizing of dust, etc. Locations are more carefully chosen, so as to escape unsanitary surroundings, noise, and other distracting influences.

Not only are bodily health conditions considered but effects

of physical surroundings upon the intellectual, æsthetic, and moral life are being regarded as equal in importance. School architecture, landscape gardening, interior finish and decorations, pictures, statuary, surrounding views, all are subjects of careful study and scrutiny in the most enlightened communities. Not only is there a desire to help develop sound bodies, but an endeavor is being made to provide physical surroundings which will stimulate healthful intellectual, æsthetic, and moral growth. Playgrounds and gymnasiums are being equipped so as to utilize one of the most deep-seated and important of instincts. Intelligent attention is being directed to the question of intermissions, holidays, vacations, length of school-day and recitation and study periods. Hungry children are being fed, the ragged clothed, the sick nursed, and the sorrowing comforted. Child labor laws are rescuing thousands from the dwarfing influences of factory, mine, and other overtaxing labor.

Not only are courses of study carefully arranged, but study periods and conditions, as well as recitation periods, are coming to be thought worthy of equal consideration. In fact, with right study conditions, most of the recitation difficulties disappear. The eyesight and hearing of children are being carefully investigated so as to correct as many defects as possible and to relieve disadvantages and embarrassment in other cases. "The examination of any public school quickly leads to the discovery that much which is taken for impaired mental activity, for lack of attention, for stupidity, or laziness may be the result of defective hearing or sight or abnormal growth of the adenoids. Growths in the nose may be operated upon, the astigmatic or the shortsighted eye may be corrected by glasses, the child who is hard of hearing may at least be seated near the teacher; and the backward children quickly reach the average level." [1]

The objective method of teaching is being given a better recognition through provision for field and laboratory work. Beginnings have also been made in the better adjustment of the

[1] Münsterberg, *Psychotherapy*, p. 189.

intellectual work to the possibilities of the child as determined by his physical and mental development.

But notwithstanding all that has been accomplished in these important directions, an exceedingly large amount yet needs to be done. Heating, lighting, plumbing, and ventilation are still far from perfect; school architecture is seldom under the control of experts who know the needs of the schools; the health of children is insufficiently protected and promoted; the greatest ignorance still prevails concerning the proper nourishment of growing children; and a scientific knowledge of how to adjust the curriculum to the varying needs of the vast numbers of children is only just beginning to appear. And of teaching what shall we say? Experts are few, their knowledge confessedly limited, and a teaching *profession* does not exist in America! But we must be optimistic, for there are unmistakable signs of progress. Many further applications of the law of psycho-physical parallelism will receive fuller treatment in subsequent pages.

CHAPTER XI

WORK, FATIGUE, AND HYGIENE

Physiological Effects of Exercise.—Whenever work is done, energy is liberated and a disintegration of tissue takes place. This is the case when mental work is done no less than when the exercise is physical. In fact, mental labor necessitates the greater expenditure of energy. Hence, "in the study of fatigue it is the changes in the material stored in the active cells at any one time that claim attention." [1]

The changes due to metabolism of the nerve-cells and consequent fatigue were first demonstrated by Hodge. He delivered some of the pioneer lectures on this subject in 1891 at the University of Wisconsin. He studied the effects of exercise upon the brain-cells of frogs, cats, honey-bees, and pigeons. By electrically stimulating the peripheral trunks of the nerves leading to the spinal ganglion of the cat, he was able to study the effects of varying amounts of exercise and rest. The nerve was stimulated for fifteen seconds, then allowed to rest forty-five seconds, the work and rest periods continuing alternately during a period of five hours. At the end of one hour the nuclei had shrunken in volume about twenty-two per cent. In some cases the shrinkage at the end of five hours was fully fifty per cent. Observations were carried on for twenty-nine hours, or twenty-four hours subsequent to the last stimulation. Complete restoration occurred within twenty-four hours. The length of time varied with different animals. Accompanying the shrinkage there was a turgescence of protoplasm, and a chemical change occurred as shown by their reaction to staining reagents. The nucleus, nucleolus, and cytoplasm of the cells themselves were

[1] Donaldson, *Growth of the Brain*, p. 311.

all affected, the cytoplasm becoming vacuolated, the muscles first increasing in size and then diminishing.[1]

Dr. Hodge studied the effects of exercise upon the nerve-cells of the pigeon, swallow, and honey-bee by examining the nerves of those killed early in the morning after a night's repose, and others of the same colony after a day's flight. He was thus enabled to discover the fatigued cells from the cortex of pigeons, those from the antennary lobes of honey-bees, from the spinal ganglia of English sparrows, and the cerebellum of swallows. The cells of the animals examined in all cases after exercise were found to be smaller and of a darker color than in fresh specimens. Other authors through subsequent experiments have corroborated many of his conclusions. Hodge also compared the cells of aged animals with those of young animals of the same species, and noted that the cells in old age present many of the symptoms of permanent fatigue.

Meaning of Fatigue.—Fatigue is produced by a chemical process. Muscular action increases the oxygen absorbed and produces additional carbon dioxide. One of the principal substances produced by fatigue of muscle or nerve is lactic acid. There is a change not only in the size and microscopic appearance of the cell, but in histological appearance. It may be easily demonstrated that the toxins formed in the blood by exercise are important, if not the principal causes of fatigue. Mosso says:[2] "They are not so much poisons as dross and impurities arising from the chemical processes of cellular life, and are normally burned up by the oxygen of the blood, destroyed in the liver, or excreted by the kidneys. If these waste products accumulate in the blood, we feel fatigued; when their amount passes the physiological limit, we become ill."

Mosso and others have performed experiments to demonstrate the foregoing idea. By electrically stimulating the nervous system of a dog, tetanus is produced which modifies the blood and gives all the symptoms of fatigue. If the blood of this dog

[1] Donaldson, *Growth of the Brain*, pp. 317–323.
[2] *Fatigue*, p. 118.

be injected into the veins of a fresh dog, the latter will at once become affected with all the symptoms of fatigue. Mosso cites other experiments in which he proves that temporary fatigue of muscles is a result of poisonous accumulations and not a result of the exhaustion of the substance of the muscles. The muscles of the frog's leg which have been fatigued by exercise can be restored to normal contractions by merely washing (injecting) with slightly saline water. Mosso makes a statement which will doubtless surprise many, viz.: "The blood, that mysterious liquid which Moses believed to be the seat of life and which Pythagoras called the nutriment of the soul, is not absolutely necessary to the functions of life, since we can remove it entirely and put saline solution in its place. The experiment is performed by cutting the abdominal vein and fastening therein a fine reed. Saline solution (0.75 per cent.) is then injected by means of a syringe until nothing but this clear liquid is circulating, and we obtain a frog which contains no blood. Frogs in this condition can live for a day or two, and during the first ten or twelve hours they are difficult to distinguish from normal frogs. It is not possible to perform such an experiment upon a warm-blooded animal, because the nervous system cannot stand so great a disturbance of its environment." [1]

A feeling of fatigue is nature's warning that katabolism is in excess of anabolism, that waste exceeds repair. It indicates a disturbed equilibrium in the machinery of life. Under normal conditions this warning is issued in time, work ceases, and repair and excess growth ensue. But in pathological cases the destruction may go on until almost too late for recuperation.

Causes of Fatigue.—Bad heredity is a usual predisposing cause of fatigue. Normally developed and well-cared-for children seldom experience pathological fatigue from reasonable work. Work under such conditions induces an increased blood supply and is a prerequisite for growth. Defective eyesight or hearing, through the strain produced, are responsible for many headaches and much fatigue. An undeveloped heart, poor

[1] *Fatigue*, p. 108.

breathing apparatus, diminutive cerebral blood-vessels, insufficient food or malnutrition, are all responsible for many cases of fatigue. They are, of course, difficult of diagnosis.

Pathological fatigue is sometimes produced in adults by overwork, in children seldom. Dissipation of energies, intemperance, and irregularities of living are much more often the cause. Smith Baker said [1] that injurious results frequently ascribed to "studying too hard" can usually be traced to something else. "Much more frequently, dangerous fatigue is the result of unhealthy confinement within doors, or is owing to unwholesome shocks, and puzzlings, and confusions, and conflicts of impulses resulting from the imposition of scatterbrain notions of teaching and discipline—imposed much too fast for the child to grow to, or even to comprehend. Or, again, it may be owing to a state of chronic apprehension and fear caused by injudicious exercise of 'authority,' largely based on certain vicious interpretations of children's characteristics, moods, and tendencies."

Galton wrote:[2] "We must be on our guard against estimating a man's energy too strictly by the work he accomplishes, because it makes a great deal of difference whether he loves his work or not. A man with no interest is rapidly fagged. Prisoners are well nourished and cared for, but they cannot perform the task of an ill-fed and ill-housed laborer. Whenever they are forced to do more than their usual small amount, they show all the symptoms of being overtasked, and sicken. An army in retreat suffers in every way, while one in the advance, being full of hope, may perform prodigious feats."

Vitiated air is a most prolific cause of fatigue. It is rare to find a school-building a decade old which is not absolutely inadequate in its appointments for ventilation. Engineering science is still wrestling with the problem of providing proper ventilation without undue waste of heat. Mastery seems a long way off. But even with the inadequate facilities for ventilation, rooms frequently contain fifty per cent. more pupils than

[1] "Fatigue in School Children," *Educational Review*, 15 : 35.
[2] *English Men of Science; Their Nature and Nurture*, p. 75.

ought to be there if the ventilation were perfect. Many teachers have dull sensibility to bad air, and even those with acute sensibility who remain in a room continuously as the poisons gradually accumulate do not notice the change readily. On the same principle that a frog may be boiled alive without feeling pain, provided the temperature is increased gradually enough, pupils may be badly poisoned from contaminated air without realizing that it is impure. The air in many school-rooms is execrable. I have visited schools in some small cities where the banks were the most conspicuous buildings, but in which the school-rooms were fairly reeking with moisture, and the odors from bodily exhalations were sickening. Dr. Amy Tanner remarks that "the air in most schools is heavy from the first half hour after school opens to the end of the day. Then the janitor locks in the bad air to be used again the next morning." [1]

Ventilation of living and sleeping rooms in the homes of pupils is seldom adequate. The superstition that night air is impure, and the fear of wasting heat, cause the majority of people to sleep in rooms with absolutely no provision for the ingress of pure air and the egress of the foul. Fresh air, the one necessary luxury that might be had in abundance by the masses, is bolted and barred by them. No habit could be of greater value to children than that of breathing in deeply and slowly pure air to completely inflate the lungs several times a day. A little attention to this will develop an appetite for fresh air which will not be satisfied with foul and insufficient air. Tuberculosis would seldom develop if living-rooms were ventilated properly and if correct habits of breathing were inculcated; and many cases of this dread disease in its incipient stages could be cured by simply learning to breathe properly.

The arrangement of our American courses of study is not conducive to economy of energy. Studies are not arranged in a psychologically sequential order. The pupil begins a subject like algebra, carries it for about a year, considers it "finished," and proceeds to geometry, which is "finished" with the same

[1] *The Child*, p. 42.

despatch. History, civics, science, and the languages are treated in the same kaleidoscopic manner. By such a method no habits of mind can really become established. Before one set of brain-paths has been developed, the "course-of-study-tinker" appears and orders a shifting of the scene. Old tracks are abandoned with loss and new ones started at great cost. The Germans have been far wiser than we in the arrangement of their curricula so as to secure long-continued exercise of the same activity. By the spiral plan (considered elsewhere) work is crossed and recrossed repeatedly from different view-points. Bonds of association are multiplied until the thought becomes permanent and habitual. While education is to broaden by variety, yet we must not fail to understand the importance of deepening and mechanizing. This is no less necessary in the most abstract association systems than in learning to walk, to button our clothing, or in memorizing the multiplication table. It is as uneconomical psycho-physically never to fix principles, laws, and systems of thought, as it would be never to mechanize the processes of spelling, writing, talking, bicycling, etc.

The ability to vary our speech to meet momentary contingencies, is no less the resultant of habits than if we were bound to a fixed form of expression. The fluent adult orator depends upon habits no less than the kindergarten child. A larger fund and greater powers of inhibition characterize the former than the latter. Royce says the reactions of the former are "as much established fashions of reaction, dependent upon the physical condition and the past training of his higher nervous centres, as sneezing and coughing are dependent upon established physical dispositions (inherited or acquired) of certain of his lower nerve centres."[1] All our reactions are dependent upon a multitude of established nervous habits which enable us to make proper adjustments. Generalized functions, though affording plasticity, are no less habitual. The law of habit in a real sense governs higher nervous centres no less than lower. "The higher habits have their fixed range of plasticity, the lower

[1] *Educational Review*, 15 : 212.

their fixed routine." A fuller discussion of this will be given in connection with the study of volition.

Fatigue Signs.—There are various, easily interpreted signs whereby fatigue may usually be detected. One of the surest signs is the decreased efficiency of work. The child works less rapidly or makes more mistakes, and the results are less uniform. Sometimes the speed is maintained, but at a great cost, as is shown by the extra exertion necessary. One who is fatigued through long-continued work or play is more apt to be of unstable temper than when fresh and vigorous. One who has lived in a family of rollicking, romping, healthy children readily recalls their irritability, the instability and the explosiveness, after a long day spent at play or after a day of school unrelieved by proper relaxation. Their condition following the play is perfectly normal and healthful, but excessive mental work performed in poorly ventilated rooms is a potent cause of pathological fatigue. Yawning is a characteristic accompaniment of both temporary and permanent fatigue. The yawning is produced by anæmia of the brain. When one is temporarily fatigued, bored, or in a poorly ventilated room, the blood becomes stagnant in the small veins of the body. Those who suffer from cerebral anæmia yawn continually. The yawning, like stretching the arms, or massage, restores the equilibrium of the circulation. When fatigued, work requiring fine motor co-ordinations is rendered unusually difficult and is inaccurately executed. This is especially noticeable in children who are given writing, sewing, basketry, or weaving. They do their work poorly, spill ink, smear their books, become inattentive, irritable, and fidgety. Older persons, when fatigued, feel acutely the strain of work when they have to do fine writing, to add long columns of figures, or think out a complex train of thought. The results may not become as much vitiated as in children because of the greater power of inhibition and control. But often the suffering is intense in accomplishing results under such conditions.

In temporary fatigue the psychic effects precede the motor disturbances. The attention wavers, irritability ensues, mem-

ory is impaired. Of course, in muscular fatigue the pain in the muscles precedes any mental warning. In neurasthenia the mental functions give evidence of impairment oftentimes before the muscular system exhibits lack of co-ordination. Children who are pathologically fatigued frequently manifest their condition by the knitting of the brows, so that permanent wrinkles ensue, fulness under the eyes appears, stammering and stuttering often may be observed, and all fine co-ordinations are impaired. Miss Holmes studied the effects of fatigue upon school-children by comparing their number work when fresh and when fatigued. When greatly fatigued, the work was both smaller in quantity and fuller of mistakes than when normal. When slightly fatigued, various deviations from the normal were noticed. Those who can maintain normal speed and accuracy in work though fatigued, do so with much greater effort and often painfully. To persist under such conditions means ultimate serious consequences.[1]

Fatigue produces inattention. Children tire easily and most of their lessons are apt to be too long. A child of six becomes so fatigued with reading or writing in fifteen minutes that the attention wanders at the slightest stimulus. It is rare that a lecturer on serious subjects can hold the attention of his audience more than an hour.

Among other symptoms of fatigue may be mentioned loss of interest, weakened will, and hypersensitivity. In permanent fatigue hypersensitivity develops into what is termed nervousness, accompanied by the apparently paradoxical decrease of power of sense-perception. Unnecessary worry over trifles and easily induced fears are frequent symptoms among neurasthenic patients. A whole train of phobias is known, such as fear of dogs, burglars, and accidents, and fear of failure in every undertaking. Diseases of the will are usually resultants of depleted nervous energy. Quack doctors flourish because of the thousands of cases of disordered imagination, usually induced through deep-seated fatigue. A degree further and the hallucinations of

[1] "The Fatigue of a School Hour," *Pedagogical Seminary*, 3 : 213–234.

the various stages of insanity appear. Even children frequently suffer from hallucinations, especially at night. The night-terrors of children are largely troublesome delusions about such things as bogey men, black dogs, and policemen. The delusions come at the end of the day when the energy of the little ones is run down and they are surrounded by the mystery and the superstition connected with the dark. Sometimes these hallucinations extend into the waking life to haunt and terrify the child.

In most cases of brain-fag among adults there is a morbid fear of disease. Because of the fear of disease and the apparent hopelessness of attaining life's ambitions, pessimism overtakes the patient, leaving him in the slough of despond. Diseased will and unreadiness to accept responsibility follow rapidly. I have known several cases where interest and light occupation would have been the means of cure, but morbid introspection and fear of failure caused the abandonment of everything attempted. One man of superlative physical strength, somewhat overworked, became so fearful of impending doom that he gave up every task he began. The fears of the day increased so at night that the approach of darkness was sufficient to throw him into hysterical crying fits. He talked with me rationally about the foolishness of it all, but while unrested could not control himself.[1] Another man of great intellectual acumen and distinction was obliged to abandon all work because he could not summon will-power sufficient to calm his imagined fears.

Children seriously fatigued are apt to be restless at night, to grind the teeth, talk in their sleep, or have nightmare. Such conditions are frequently consequent upon worry about grades and "passing" at school, upon long examinations, too late hours, over-excitement about parties, etc. Bad dreams or some terrifying spectacle witnessed by the child often persist, causing a useless expenditure of nervous energy. Stories of fairies, goblins, and spooks may excite the child mind abnormally, causing depletion of energy. Even over-indulgence in reading imagina-

[1] Since his complete physical recovery he has become perfectly normal mentally.

tive stories may prove a source of undue dissipation of energy. Emaciation, pallor, and languor are not infrequently observed in children and adolescents who do nothing but day-dream.

Effects of Fatigue on Memory.—Mosso relates that in his own case fatigue destroys both attention and memory. The labor of ascending Monte Vico and Monte Rosa so affected him that he says he remembers nothing that he saw from their summits. "My recollection of the incidents of the ascents becomes more and more dim in proportion to the height attained. It seems that the physical conditions of thought and memory become less favorable as the blood is poisoned by the products of fatigue, and the energy of the nervous system consumed. This is the more singular in my case because I have a good memory for places." [1] His experiences are corroborated by those of other mountain-climbers.

For a time in my teaching experience I gave three consecutive lectures each day from 9 A. M. to 12 M. These classes were different sections carrying the same work, and the lectures were duplicates. On several occasions I found my memory playing me false in the third hour, while I had experienced no difficulty during the first hour, and had improved upon the work the second hour. Mosso writes:[2] "Professor Gibelli told me that in botanical excursions his memory diminishes as soon as he begins to be fatigued, and eventually he becomes unable to recall the names of even the commonest plants. Rest very soon causes this phenomenon of fatigue to disappear." "The fatigue accompanying work is not so great when the subject is working under the direct stimulus of a definite aim, notwithstanding the fact that he has at the same time produced an increase in his amount of work." [3]

Experimental Investigations.—Titchener says of fatigue, that "In experimentation, it is directly dependent upon the number of observations taken in a single series, and is indicated by a steady decrease in delicacy of perception and readiness of judg-

[1] *Fatigue*, p. 200. [2] *Ibid.*, 201.
[3] Wright, Wm. R., *Psychological Review*, 13 : 23–34.

ment. It is characterized by (1) a weakening of attention, (2) a diminished capacity of reproduction, and (3) the prominence in consciousness of certain organic sensations." [1]

Mosso and several of his associates have studied fatigue experimentally with great patience. By means of the ergograph, an instrument which allows a single set of muscles, as those of the finger, to be exercised, he has studied the progress of fatigue in that set of muscles. He has also studied the influence of different periods of mental work upon the amount of force available for the muscular work upon the ergograph. Smedley has used the instrument in connection with his child-study work in the Chicago schools. O'Shea has given us some records of ergographic experiments arranged by him.[2]

Various investigators, such as Griesbach and Leuba, have tested fatigue by means of the æsthesiometer, an instrument designed to test sensibility to touch and pain. Tests in relation to fatigue are made before and after periods of physical or mental work. The sensitivity is supposed to be an index of the fatigue. Other instruments, such as the plethysmograph and the sphygmograph, have been extensively used. The former measures blood-pressure and the latter pulse-rate. The sphygmograph has been used especially by Binet and Henri. Inasmuch as all of the physical tests have as yet yielded such meagre results and are so difficult to apply in the school-room, the detailed methods and results will not be entered upon here. However, while the results are meagre they are very suggestive, and consequently a few references will be mentioned which will indicate to the special student where he may begin if he desires to pursue the subject further.[3]

[1] Baldwin's *Dictionary of Philosophy and Psychology.*

[2] O'Shea, *Dynamic Factors in Education,* chaps. 12, 13, 18.

[3] Mosso, *Fatigue,* translated by Margaret and W. B. Drummond; Binet et Henri, *La Fatigue, Intellectuelle;* Bergström, "An Experimental Study of Some of the Conditions of Mental Activity," *American Journal of Psychology,* 6: 247–274; Griesbach, *Energetik und Hygiene des Nerven-Systems in der Schule,* München, 1895, 97 pp; Lindley, "A Preliminary Study of Some of the Motor Phenomena of Mental Effort," *American Journal of Psychology,* 8 : 431–493; Lukens, "The School Fatigue Question in Germany," *Educational Review,* 15: 246–254.

Sikorsky tested children quantitatively for signs of fatigue as evidenced by less efficient work in writing certain material from dictation. From one thousand five hundred tests involving forty thousand letters, he found that after four or five hours of work there was an increase of thirty-three per cent. in the number of errors. Burgerstein had children perform examples in addition and multiplication during four consecutive periods of ten minutes each, separated by five-minute intermissions. He found that the number of single additions and multiplications was least during the first period, but there were also fewer errors. The second period was better in amount of work than the first, showing the necessity of becoming "warmed up." The number of errors was also larger. The results in the last period were better in quantity than in the third, showing a recovery. There were more errors, however, than during any other period.

Laser tested for indications of fatigue by having pupils work examples at the beginning of each hour period for five hours. His results showed: (1) that the amount of work was least in the first hour, (2) that the amount increased up to the third or fourth hour, but diminished in the fourth or fifth, (3) the number of errors increased up to the fourth hour, but diminished in the fifth, (4) the number making no mistakes at all decreased from the first to the fifth hour. Höpfner tested a class of forty-six boys of nine years by dictating nineteen sentences at intervals during a two-hour period of work. There were .9 per cent. of errors in the first sentence, which decreased to .6 per cent. in the fourth sentence, and then the increase was quite regular up to 6.4 per cent. in the nineteenth sentence.[1]

Dr. Thorndike discredits most of the theories concerning fatigue and the experimental data which have been collected in studying the subject. He experimented upon himself, performing uninteresting multiplications at the beginning of a day and also at the close of the same day, after a long, hard day's work.

[1] The four preceding experiments are reported in Kotelmann's *School Hygiene*, translated by Bergström, pp. 173–176. See further, Mosso *op. cit.*, chap. 7; Dresslar, "Fatigue," *Pedagogical Seminary*, 2 : 102–106.

He says:[1] "In every case the evening examples represented a state of mind which had led the subject to stop work on the ground that he was fit to do no more. To start the work of the experiment was very irksome and required some exercise of determination." His results led him to assert that he could do as much work at the close of the day as at the beginning and that "we can *feel* mentally fatigued *without being* so." He tested school-children in a similar manner and concluded that their power of actually doing work at the close of the day is as great as at the beginning. He says that although the children said that "they were tired in the late hours, and thought that they couldn't work nearly as well, yet these same children *did* do just as well in the tests given." He further maintains[2] that his results "prove that the work in the case of the schools tested *did not decrease one jot or tittle the ability of the scholars to do mental work*." He believes that "The great burden of the child (and of many of us grown children) is not doing things that are *hard*, or that *hurt*, but doing things that are stupid and sickening and without worth to us." He prescribes "good teaching" as a remedy for decreased work apparently due to fatigue, believing that it would cure 90 per cent. of all cases.

Undoubtedly much fatigue is purely imaginary, as Dr. Thorndike suggests. But he has evidently overlooked a very vital point concerning many cases. Even though as much work is done at the close of a long work period, it is done, as he admits, under the *feeling* of fatigue and with great effort. What causes the feeling of discomfort or fatigue? Why the extra effort necessary? It is the exhausted or disturbed condition of the nerve-cells. The feeling of discomfort is the signal that danger will ensue unless the signal is heeded. I frequently close an hour's public address with greater activity than I began it. My voice is stronger, steadier, my sentences smoother, and my ideas readier. But as soon as the lecture closes I feel all the effects of overwork and exhaustion. My voice becomes so husky

[1] *Psychological Review*, 7 : 469, 481.
[2] *Ibid.*, pp. 547, 570.

that I lose control of it and can scarcely speak aloud, I feel limp in body, and can only feel comfortable by lying down at once. Sometimes my sleep is disturbed, and I feel aches and pains. Now, what is this condition if not fatigue?

Periods of Work and Rest.—No absolute rules can be laid down with reference to periods of work and rest, because there are such enormous individual differences in this as in other characteristics. Some persons can walk only a short distance without great fatigue, while others can tramp all day without rest or experiencing fatigue. Some can do continuous, heavy physical work, but only at a slow pace, while others work by spurts and then require rest. Similar conditions obtain in mental work. Some men work from fourteen to sixteen hours a day the year round without a vacation, while others seem never to be at work but really accomplish astonishing results because of the intensity while occupied. University students vary greatly in their methods and powers of mental work. One spends as much energy, and as effectively, in fifteen minutes as another in two hours. The former, however, has to learn to rest and vary his work.

It is often maintained that during the morning hours far more work can be accomplished than at any other period of the day. It is assumed that the night-time *per se* is responsible for the fatigued condition and the morning hour for the abundant vigor. According to these assumptions, then, would not the day-time hours be the best for invigoration through sleep? It is doubtless true that the best work is usually accomplished with the least effort in the morning, after a night's refreshing sleep. But it is also probably true that such is the case because of the sleep, rest, and recuperation rather than because of the time of day.

The relations of periods of work to periods of rest, sleep, and times of eating are much more determinative of fatigue than is the time of day. Those who work nights say that they can work equally as well at night as during the day. Some students and writers do their main work early in the day—sometimes

before breakfast. But that is largely a matter of personal habit. Others do their very best brain-work at night—between eight and twelve or one o'clock. The nervous system and the mind become habituated through custom to functioning in certain ways at certain times and laws become established. Just as we fall asleep after lunch almost in spite of ourselves if we have become accustomed to it; just as we waken in almost exactly twenty minutes if that has been the allotted time; so the mind is ready to work with a given momentum and upon given problems at certain definite periods. Because of habituation of attention during the day-time to my routine work and to devotion of my hours of lamplight to writing and new work, I find that it is not easy to interchange. If I seat myself during the day-time to write an article, dozens of routine matters come unbidden to my attention and it seems as if my mind will not work freely upon the new matter until the accustomed hour. Of course, at that later hour the disturbing factors of the day are no longer present; the bright sunshine, the beautiful flowers, or the friendly fireside chat no longer command attention. But as I have repeatedly analyzed the case, it seems to me as if my whole make-up were more ready for particular kinds of activities at certain times, previously determined by habituation through experience.

According to our habits of eating and sleeping, it is true that the best hours for school-children are in the morning from about eight to eleven. This is especially true if a light, though nutritious, breakfast follows eight or nine hours of refreshing sleep. The hour preceding lunch, usually from eleven to twelve, is a poor hour, because of the need of nourishment and because of the previous work. The hour immediately following lunch is also a poor hour for work, because the blood is drawn away from the head to the stomach to promote digestion. The hours from two to six are favorable for work, although they may not be so good as the morning hours. This is true only because they are farther away from a period of refreshing sleep, because the funds of nervous energy are more nearly run down, and

because of the cumulative effects of the toxins formed by exercise. But, as stated above, whether the brain and mind act readily or sluggishly depends much upon habit. It is stated by Frank G. Carpenter that Dr. Alexander Graham Bell, the great inventor, has done most of his thinking after dark, finding that his mind works better when all is quiet. He considers the hours from midnight to four o'clock as the preferred time. During the summer months he seldom goes to sleep before dawn and his hours for sleep are usually from four to eleven in the morning. His afternoons are devoted to business and social engagements and his nights to scientific experiments. He maintains that this plan is in no wise injurious to his health and he prefers these hours instead of daylight for work. "Indeed," says Carpenter, "night and day are much the same to him, and when he is especially interested in some of his experiments he goes many hours without sleep, working on far into the day and then sleeping for hours at a stretch to make up."[1] Edison is said to utilize the night hours almost as much as the day. It would be easy to multiply cases to show that habit and the personal equation are very large factors in questions of work and fatigue.

Daily School Program.—The daily program of the school should be so arranged as to produce a minimum degree of fatigue and also to place the most arduous occupations at the period of the day when pupils are freshest and most able to resist fatigue. From the nature of the subjects, mathematics, languages, grammar, any memoriter work, or any requiring long trains of ideas to be held in mind, are most fatiguing. It is not always the work requiring greatest ingenuity or depth of thought that tires most. The psychologist obliged to add long columns of figures used in his experiments finds the adding much more fatiguing than the more profound thinking. The mathematician even finds adding columns more fatiguing than handling complex equations. Practice will, of course, reduce the fatigue in adding. But, in general, any work requiring a prolonged un-

[1] *Chicago Record-Herald*, September 2, 1906.

broken chain of associations is fatiguing until paths of association become "grooved" as it were, *i. e.*, until habits are formed.

Another caution which should be thrown out is against too much and too difficult home work. If pupils below the high school are diligent through five or six hours a day five days in the week, little home work should be exacted, especially work of a difficult nature. It is almost criminal to require ten-year-olds to work out their arithmetic lessons at night, especially when the teacher makes himself a *lesson-hearer* instead of a teacher. (And I am sorry to admit that thousands of our teachers are mere monitors who hear children recite.) If children are given any home occupations, they should be merely mechanical operations relating to principles thoroughly developed in class, or some light and absorbingly interesting work. The Germans give only work which is for the purpose of *Ergänzung oder Einprägung* (widening work already learned or impressing principles through application). The best kind of subjects for home work would be literature, biography, the study of history, travel, or observations of natural phenomena requiring easily performed experiments, or excursions. What a wealth of observations might be made, and materials collected, by going in groups with the teacher, or even alone. All the fields of natural science, agriculture, history, geography, civics, and others, are open. The subjects are too often barren just because they lack this observational phase. For work by the fireside the literature of the ages offers tempting excursions. Instead of opening up this field, teachers too often assign for home work abstract forms and formulas to be mumbled over. If such work is mastered it is usually by the help of the parents.

Pupils should not be allowed to sit for unduly long periods. The monotony causes strain and fatigue of certain parts which affect the whole body and the mind as well. Undue tension should never ensue through excessive formalism. Ease of posture and liberty of movement should always be allowed, to the limits consistent with reasonable order. I know of schools where both pupils and teachers are continuously keyed

to the breaking-point over finicky matters of order. Demerits are given if a pencil drops, a pupil glances up, looks out of a window, or turns around. The pupils live in mortal dread of "sinning" and incurring the wrath of the hypercritical monarch. Watch any company of adults, and well-behaved adults too, and see if they comport themselves at lectures, church, or teachers' meetings as the children are commanded to at school.

The German plan of allowing an intermission between periods is commendable. It should, however, be a period of complete relaxation, and not one devoted to calisthenics or formal marchings. It is usual in American schools not to give an interim between classes, and to preserve strict silence while in class and also while passing between classes. This is a mistake. Professor Ensign, for many years an exceedingly successful principal of the Council Bluffs, Iowa, high school, made it a practice to encourage chatting, visiting, laughter, and general relaxation while passing to and from classes. By this means the pupils drafted off pent-up, superfluous energies, equilibrium was restored, more cheerful feelings engendered, and much better work secured. Martinet discipline causes the unnatural inhibition of many automatisms and reflexes. This repression produces worry, fidgetiness, and a leakage of nervous energy.

I firmly believe that the majority of all the problems of discipline arise from the unnatural repression to which pupils find themselves subjected. The long rows of seats and desks in which the pupils must remain almost as immovable as wooden soldiers, with prohibitions against turning around, communicating, leaving seats, dropping things, or even turning away from books to rest the eyes, all tend to produce rebellious feelings and pent-up energies which must be given a chance to secure relief by some means or other. The whole plan of the "study period" has been wrought out without a knowledge of the first principles of psycho-neural laws and in every direction counter to them.

Recuperation.—When the meaning of fatigue and its causes have been set forth, the means of treatment and relief appear

plain. The work must cease and some means be employed to restore the circulation. If a particular organ or part has become fatigued through congestion, this condition must be relieved, the part irrigated with rich nutriment, and the equilibrium restored. If fatigue has resulted from exhaustion of nervous or muscular energy, cessation of the work is necessary, and rest, sleep, or nourishment must restore the worn-out portion. Mosso claims that the store of energy is not highly specialized, but rather general, and hence nervous fatigue means fatigue all over.

The proverbial statement that a change of work is as good as a rest is certainly incorrect when applied to cases of fatigue due to depleted energies. The teacher who requires the child wearied with arithmetic to turn to grammar, simply because it is different, is making a great blunder if restoration of energy is expected to result. The blunder is equally egregious when gymnastics and military exercises are substituted. More teachers are ignorant on this point than on the preceding. To succeed in gymnastics demands attention and will-power of a high degree, and brain energy is depleted as rapidly as in the study of mathematics. Nothing but rest, nutrition, and complete relaxation will suffice. It was a sorry day when indoor calisthenics were substituted for absolute free play and relaxation out in the open. The muscular exercise, instead of relieving the cerebral fatigue, adds another kind of work equally fatiguing. For the purpose of relieving fatigue produced through congestion, free play and the old-fashioned recess have never been equalled.

A right understanding of fatigue will dispel the idea that students who engage in long hours of hard manual labor are thereby made the better students, and will give a more rational view of athletics and sports. Foot-ball enthusiasts are apt to advance the specious argument that the severe and prolonged physical exercise promotes mental vigor and increases the amount and improves the quality of mental work. That is absolutely untrue. The man who "works" several hours daily "playing" in severe athletic contests has a lessened, rather than an increased, quantity of brain energy at his disposal. The

fact that he sometimes attends both to studies and team work successfully is due not to the increased efficiency resulting from athletics, but to the possession at the outset of an unusual combination of mental and physical qualities.

Likewise the students who support themselves by excessive manual labor or night work usually have difficulty in refraining from napping in class. Believing in the popular superstition that hard physical work promotes intellectual activity, as a student I tried to keep up my studies during the summers on the farm. I found farm work and efficient study incompatible, and at that time felt a secret twinge of conscience for my supposed lack of moral fibre. I could neither accomplish much study nor maintain an interest in the details, although I was, in general, always interested in study. I have later felt a sense of relief in knowing that I was not much of a sinner after all. Of course, I might feel some approbation had I been able to overcome more of my racial tendencies and achieve results such as are credited to the heroes who worked hard all day and then labored over their books far into the night by aid of the pine fagot or the tallow dip. But, as I am no blind hero-worshipper and am a scientific sceptic, the profane question will occasionally pop up unbidden as to whether those heroes really did work many nights and whether they did really read much Greek that way? Their accomplishments in that line may have been somewhat like those of our venerated grandparents in spelling, writing, and ciphering. Occasionally an authentic document is made available by which we may compare their renown and their actual achievements.

O'Shea remarks[1] that: "Brain workers will probably be benefited more by activities requiring the greater use of the fundamental than of the peripheral muscles. Gymnastics and games, then, should not require too exact and delicate coordinations, since it would seem that student life really demands enough of this sort of thing in the prosecution of studies. The

[1] "Aspects of Mental Economy": *Bulletin of the University of Wisconsin*, p. 162.

cerebral areas controlling the peripheral muscles are doubtless involved in thinking, and it is desirable that our recreation should relieve these areas from active exercise while calling others into play. Again, it seems to me especially desirable that our amusements should engage the muscles principally rather than the mind. Cards, checkers, authors, and the like must be poorly suited to the needs of those who use their heads constantly in their regular employments. . . . A student's life economically planned would aim to expend in study all of the energies which should be devoted to intellectual activities, while recreation would involve motor activities almost wholly."

Mens Sana in Corpore Sano.—The first and foremost great aim of mental dietetics that should be impressed early and often is that one long ago stated by Juvenal, viz.: *Mens sana in corpore sano.* Every parent and every teacher should understand that the first business of the child is to become a good animal. Childhood years should be largely vegetative. The child's primal inheritance is physical. Big lungs, firm muscles, an elastic step, ruddy cheeks, scintillating unspectacled eyes, and senses alert at the close of youth are priceless possessions, with which a knowledge of algebraic formulas, a foreign language or two, or a few dates in history are not to be compared.

Permanent Fatigue.—"It may be true that that age (forty) marks in intellectual men usually a transition or the point where the accumulated losses which have been occurring from birth on reveal their effects clearly, but in the great majority of men comparative mental fixity surely occurs at a much earlier period. If you will allow me to wander for a moment from the strict discussion of our immediate theme, I should like to refer to what may be called the theory of permanent mental fatigue. The organic changes which go on in the nervous system diminish its pliability and there comes a time when the individual finds it exceedingly difficult to bring his mind into any unaccustomed form of activity. How completely we are mastered by this difficulty is often hidden, I believe, from our recognition and from that of our friends, because we have acquired certain habits

of activity which we are able to keep up, but we are not able without ever-increasing difficulty to turn to new forms of mental activity, or in other words, to learn new things. When we grow old we may still continue to do well the kind of thing which we have learned to do, whether it be paying out bills at a bank or paying out a particular set of scientific ideas to a class of students. If we try to overstep the limits of our acquired expertness we find that we are held up by this sense of permanent mental fatigue. Usually this condition comes about gradually, but I have known, as I presume you all have, several cases in which it has appeared suddenly, where a man who up to a certain time was fond of mental exertion suddenly ceased to be mentally active. We have probable illustrations of this in the careers of well-known scientific men. I think the theory of permanent mental fatigue, in connection with the theory of gradual decline . . . could be usefully developed and might well be utilized by the psychologists in their studies." [1]

Modern High-Pressure System.—With the increase of man's potentialities, we must also reckon with the fact of the multiplied ways of inciting and exciting to depletion of powers. As an illustration let us note the excessive stimulation to which the eye is subjected. In our present civilization we have come to depend more and more upon vision. The strain upon the eye in gaining a knowledge of the objective realities about us has been increased a thousand-fold by modern modes of travel. In addition we must use the eye to interpret language symbols about myriads of things inaccessible to personal inspection. Primitive man had only a narrow range of things to see, and those usually at some distance. Hence he knew not eye-strain resulting from the microscopic scrutiny of a vast ever-changing, kaleidoscopic scene. Formerly man could deliberate in seeing the few things within his range. But now he becomes a globe-trotter, compacting into a few weeks the view of scores of nations, vast expanses of country, the collections of ages, and the maddening activities of the heterogeneous throng. In a week's jaunt

[1] Minot, *Age, Growth, and Death*, pp. 245–246.

visiting a world's fair, present-day man sees more, hears more, than was possible in a whole life, a century ago. Besides these activities the eye must do duty in reading the twenty-four-page daily, the forty-eight-page Sunday edition, scanning a half-dozen weeklies, and going through a cartload of magazines, to say nothing of all the latest books which one is supposed to read.

The ear is equally assailed with the ceaseless hum of voices, door-bells, and telephone calls, the whir of the trolley, the shriek and clang of the locomotive, the maddening grind of the sleeping-car or the twin-screw steamer upon which we take our vacation tours, the deafening roar of the factory, the clatter of galloping hoofs and the rattle of wheels over paved streets. Even at night we must be assailed—business must not stand still—goods must be sent by return mail, limited trains must outdo other limiteds, and everywhere new "records" must be established. Even on Sunday we are not permitted to listen to restful sermons—they must be such as to give rise to glaring headlines and the music must be of ear-splitting pitch.

Significance of Fatigue in Heredity.—The question of fatigue is of vast importance, not only having a relation to the arrangement of the daily program, to the amount of work, periods of rest and recreation, but in a still larger way affecting the whole life of a people. Habits of life which produce permanent fatigue of great numbers of people may mean the loss of place and power, or even the extinction of nations. Great numbers of people in all civilized countries have been thoroughly aroused by the question, many discussions have ensued, and much literature has been produced. The *Überbürdungsfrage* became a national question in Germany a few years ago. As early as 1886 the Paris Academy of Medicine ascribed a long list of children's diseases to the fatigue incident to school life. Physicians in our own country have sounded a warning not only against over-pressure in schools but against all forms of headlong rush and over-excitement which seem to be over-stimulating and devitalizing our American life. "Americanitis" may be or may

become more than a jest. Hereditary "laziness" would not be an impossible, but a probable, ultimate consequence of a few generations of living at an exhausting pace.

We are wont to think of the invention of machinery as relieving many from toil and fatigue. Mosso comments upon this idea in a way which certainly suggests the necessity of regulating and reducing the hours of enslaving toil from tending certain kinds of machinery. He writes:[1] "One very quickly perceives, however, that those machines are not made to lessen human fatigue, as poets were wont to dream. The velocity of the flying wheels, the whirling of the hammers, and the furious speed at which everything moves, these things tell us that time is an important factor in the progress of industry, and that here in the factory the activity of the workers must conquer the forces of nature. Beside these roaring machines are seen half-naked men, covered with sweat, hurriedly pursuing enormous weights, which whirl round as if a mysterious hand were raising them. The hiss of the steam, the rattling of the pulleys, the shaking of the joints, the snorting of these gigantic automata, all warn us that they are inexorable in their motion, that man is condemned to follow them without a moment's rest, because every minute wasted consumes time which is worth money, seeing that it renders useless the fuel and the movement of these colossi. The least distraction, the least mistake may drag the workers beneath the grinding teeth of the wheels; and the imagination recoils horror-struck before the mutilations, the deaths, with which these monsters punish the slightest carelessness, the slightest hesitation on the part of those who direct them." All this produces a tension and strain which must eventually sap the very life-energy from the strongest and contribute to race deterioration.[2]

Health of School-Children.—Paul wrote: "What? know ye not that your body is the temple of the Holy Ghost which is in

[1] *Fatigue*, p. 171.

[2] See *Bulletin* 30 *of the Committee of One Hundred on National Health. Being a Report on National Vitality*, prepared by Prof. Irving Fisher, pp. 44–48.

you?"[1] So well established is the idea that a sound mind can be developed only in a sound body, that very properly a large share of attention is devoted to the consideration of the health of school-children. Splendid efforts have been made to provide commodious buildings, hygienically heated, lighted, and ventilated. In enlightened communities the school-house site is chosen in the most healthful location possible, and the grounds are ample for plays, sports, and recreations. Athletics, games, out-door exercises, and gymnasium work are encouraged, utilized to correct defective or abnormal tendencies, and in manifold ways made to contribute to bodily tone and vigor as well as to provide incentives for school attendance.

Through the awakening of the public to a consciousness of the importance of bodily health, not only because of its effect upon the individual, but on account of its far-reaching racial effects, many reforms in school conditions are being secured. Buildings are being constructed in accordance with the best ideas of heating, lighting, plumbing, color of walls, etc. Greater precautions are taken to secure building-sites on well-drained ground, removed from the disturbing noises and dangers in congested districts. Play-grounds are no longer considered luxuries by enlightened citizens. In New York costly mercantile buildings in the heart of the most thickly populated districts are torn down to make room for play-grounds. The gymnasium is coming to be considered as necessary as the library or the laboratory. School baths are being provided at public expense, and the paternalism of the state goes so far in some cases as to require the pupils to take them. Physical culture is given a regular place in the required list of exercises in many schools and colleges. The diet and nutrition of school-children is properly made an item of consideration. The mid-day lunch is often furnished on the school premises and is prepared according to the most hygienic principles. In not a few instances the public provides food for indigent children who come to school so ill nourished that effective mental work is an impossibility.

[1] 1 Cor. 6 : 19.

Dr. Hall has said:[1] "A ton of knowledge bought at the cost of an ounce of health, which is the most ancient and precious form of wealth and worth, costs more than its value. Better Tolstoi's kind of liberty, or the old knightly contempt of pen and book work as the knack of craven, thin-blooded clerks, better idyllic ignorance of even the invention of Cadmus, if the worst that the modern school now causes must be taken in order to get the best it has to give. Sooner or later everything pertaining to education, from the site of the building to the contents of every text-book, and the methods of each branch of study, must be scrutinized with all the care and detail at the command of scientific pedagogy and judged from the stand-point of health. What shall a child give in exchange for his health, or what shall it profit a child if he gain the whole world of knowledge and lose his own health?"

Medical Inspection of Schools.—Medical inspection of schools should become universal. The hygienic conditions of the surroundings under which children work and play should be regularly inspected. The frequent, appalling consequences of unnecessary contagion should be checked. Where regular physicians have been employed the wisdom of the measure has been demonstrated. With the congestion of population in cities the need for medical inspection of schools becomes greater. Statistics are almost overwhelming in the appeal they make to us for the medical inspection of schools. During the year 1895, in Boston, the medical inspector made 16,790 examinations. Of those examined, 10,737 were really ill. This indicates that not many needless examinations were conducted. Among those examined, 2,041 were too ill to remain even for the day. The number of cases of contagious diseases which should have been recognized at home was something appalling. There were 77 cases of diphtheria, 28 of scarlet fever, 47 of scabies, 116 of measles, 33 of whooping cough, 28 of chicken-pox, 47 of mumps, 8 of congenital syphilis. The results of inspection in Chicago revealed similar conditions. During the four months ending

[1] *Pedagogical Seminary*, 2 : 7.

April 30, 1900, there were 76,805 examinations made, and 4,539 pupils were excluded from school. Of these 170 were afflicted with diphtheria; scarlet fever claimed 401; measles, 648; whooping cough, 55; chicken-pox, 670; tonsilitis, 689; mumps, 1,160; purulent sore eyes, 55; impetigo, 193; pediculosis, 241; ringworm, 76; eczema, 48; other diseases, 133.

"In the Chicago schools, during the first six months of this year (1909), 249,840 children were examined, and 32,159 were temporarily excluded because of contagious diseases. There were 72,061 examined for physical defects, and nearly 38,000—more than one-half—were found defective—the teeth were defective in more than 26,000 (1 in every 3); the tonsils in more than 17,000 (1 in every 4); the vision in nearly 14,000 (1 in every 5), etc." [1]

And all the children thus afflicted were sitting by the side of other children, spreading their contagion broadcast! All were sent by their parents, who, according to extreme individualists, should not have their rights interfered with. If public investigation of school conditions and the isolation of such cases means paternalism, then give us more, yea, infinitely more paternalism! The great prevalence of physical and moral contagion to which little children are exposed in our public schools makes thinking parents hesitate before sending their children where any day they may become inoculated with germs that may result in physical or moral diseases of the most loathsome kind. The great number of epidemics of measles, scarlet fever, mumps, whooping cough, etc., that annually find their centre of dissemination in a school-room, where the germs have been carried by children from homes oftentimes entirely ignorant of and indifferent to the simplest laws of health, should not fail to impress us with the desirability of checking them. If Edward Bok's statements are true, and they are doubtless true in the main, that fifty thousand children are annually made nervous wrecks, and if parents are continually lamenting the nervous breakdowns of their children, there is certainly cause for alarm.

[1] Votaw, "Moral Training in the Public Schools," *Biblical World*, 34 : 298.

While Mr. Bok is wrong in charging all to the public schools, he is undoubtedly correct as to results. The schools are not primarily to blame for the nervous prostrations and early deaths from consumption. "The sins of the fathers," dissipation of energy in late parties, insufficient sleep, insufficient and improper food, lack of exercise, long hours at the piano instead of in the kitchen or at play, the curses imposed by fashionable but murderous costume, the deadly microbes gathered up and carried home by the mother's ultra-fashionable skirts sweeping our filthy sidewalks, the demands made by foolish parents that children constitutionally weak do all that the stronger neighbor children do, the outside music, the extra work in the store, these and many other causes for which parents themselves are to blame are more frequently the cause of pulmonary diseases and nervous collapse. But setting aside the causes, the distressing fact remains that these pitiable cases are in school, and many parents have neither the knowledge nor the good sense to prevent the blighting conditions nor to remedy the evils when under way. It then remains for the school, as a guardian and promoter of manhood and womanhood, to protect against evil tendencies and combat disease and contagion.

In villages and small towns the school physician might be the health officer of the town. Such a position would give him something of exceeding importance to do. Instead of going around town tacking up diphtheria and scarlet-fever signs after the disease had been spread broadcast and the schools closed for a month's vacation, he could be extremely useful in preventing the spread of disease. By combining the duties of the health officer and the school inspector very little additional cost would be involved, and no great amount of persuasion would be necessary to inaugurate the plan. The plan is feasible because it has been tried successfully. Large cities can well afford to employ one or more experts to devote all their time to the psycho-pathological work. Chicago employs an expert consulting psychologist, besides fifty or more physicians who devote part of their time to these extremely important preventive and

alleviative measures. In the future—which I believe is dawning—let us hope that the appropriations for reformatories and reformatory measures may be materially diminished, while for *formative* and preventive measures they may be infinitely increased.

There is a world-wide movement to secure medical inspection of schools and better school sanitation. European countries, especially Switzerland, have led in this altruistic movement. However: "At present medical inspection is the exception, rather than the rule. Only 70 cities in the United States, outside of Massachusetts, and 32 cities and 321 towns in Massachusetts, have systems more or less complete. New York employs 150 physicians, who visit each public school once a day to examine children set aside for that purpose by the teacher. In Providence a fresh-air school for children suffering from tuberculosis has been established." [1]

In Chicago, during the first six months of the year 1909, "the school nurses have been busy looking after the diseased or defective pupils. They have visited the homes of 45,000 pupils, to arrange that the children may be properly taken care of, and under the direction of physicians have actually treated more than 23,000 children. The school authorities find that many parents do not give attention and care to the health of the children—their defects of teeth, vision, hearing, breathing, or nutrition are neglected, and as a consequence the children are left to struggle along with severe handicaps if not with actual pain. So the public schools have assumed the enormous task of securing health for as many of the boys and girls as possible. This means also that the school buildings and the methods of instruction shall be in the best sense hygienic, and that the pupils as they progress through the school years shall be taught health in an all-round and effective way. The physical health which is thus built up makes for higher attainment both intellectually and morally." [2]

[1] Fisher, *op. cit.*, p. 8.
[2] Votaw, *loc. cit.*

The Inflexible Graded System.—One point remains to be noted. If these nervous breakdowns accompanying school work are to be successfully resisted, the school grade in its extreme inflexibility must go. Parents will always want their John and Mary to be at exactly the same point in their work and to carry exactly the same amount of work as their neighbor's John and Mary. Custom is a mighty force which rules the world. What "they" do, what "they" say, are among the most constantly operative stimuli in an adult's life. Now if the superintendent and school physician could say that John should rest for three weeks or that he should take only two of the four studies, which he could do if the grades were not the gods to be appeased; if John could graduate a few weeks later when he individually had completed the work, he could work along calmly and without detriment. The school grade, so dear to the mechanical teacher, is a Juggernaut under whose ever-grinding wheels are annually crushed thousands of innocent children whose cries go up to heaven in a wail against this wholesale sacrifice of life and individuality.

Sleep and Efficiency.—Sleep is an important factor in the development of the child and the youth, to which inadequate consideration has been given by parents. Dr. Hall has said that no child should be allowed to go to school without having had nine hours of sleep and a good breakfast. In the average home little attention is given to the amount of sleep of the children, and the conditions under which it is taken. Without doubt a large percentage of the cases of nervous breakdowns reported among high-school pupils could be traced to irregular, inadequate, and unrefreshing sleep. Dr. Francis Warner,[1] a noted authority on child study and on nervous diseases, records with approval the following tabulation furnished by Dr. Clement Dukes of the desirable amounts of work and sleep for the different ages of childhood and youth:

[1] *The Nervous System of the Child*, p. 124.

TABLE SHOWING DESIRABLE NUMBER OF HOURS OF WORK AND SLEEP AT DIFFERENT AGES

AGE	HOURS OF WORK PER WEEK	HOURS OF SLEEP PER NIGHT
5–6	6	13½
6–7	9	13
7–8	12	12½
8–9	15	12
9–10	20	11½
11–12	25	11
13–14	35	10
14–15	40	9½
15–17	45	9
17–19	50	8½

Defective Eyesight.—So important are the senses of sight and hearing in the acquisition of knowledge and so frequently are these senses impaired, that a special brief section will be devoted to each. References will be given for the guidance of those who need to investigate further. Persons blessed with sight gain a vast range of ideas which are absolutely denied to the blind. Primarily all our ideas of light and darkness, colors and shades, with all that these mean in acquiring real ideas of the world about us, and all our ideas of drawing and painting, are dependent upon sight. Form and size also are largely determined by visual signs. Helen Keller, blind through life, can never know color, can never understand painting and drawing as the seeing do. All her ideas of form and size are gained through touch, and color can be only a word with her. Newspaper accounts have credited her with real knowledge of light and color, but this is all the fiction of some newspaper writer's inexact thinking. It is scarcely necessary even to suggest the importance of good sight as a means of knowledge getting and of enjoyment. Every one who sees appreciates it in a vague way, but only those who have become blind after experiencing the advantages and joys of sight really appreciate it to the full limit. Not only are the blind deprived of certain cardinal facts, but their whole brain and mental development suffer therefrom. The lobe of sight

in the brain of Laura Bridgman was found to be much thinner and less well developed than the other lobes of her brain, and less developed than the corresponding lobes in normal individuals.

Recent investigations have revealed the fact that many pupils fail to do good work because of defective sense-organs. Many persons are afflicted with defective eyesight who are not aware of it. Color-blindness is seldom discerned by the one afflicted until tested. Having never known any different perception of the world it seems to him the natural condition. Who can tell the number of railroad wrecks, due to ignorance of this defect, which occurred before scientific tests were applied? While the defect causes no special inconvenience in ordinary pursuits, how absolutely essential it is in railroading! In occupations such as painting, millinery, dressmaking, selection of dry goods, etc., many failures might be traced to color-blindness. Because of other visual defects, how many children have been dubbed dunces in reading when they miscalled words or were slow in making out new words? The near-sighted child fails to see the blackboard and misses much that children with normal vision get. Headaches, nervous irritability, and many other defects are often due to astigmatism, weak eye muscles, or other sense defects. A case came to my notice recently of a senior girl in the high school who was said to be threatened with nervous prostration. Her eyes were examined, a bad case of astigmatism discerned, glasses fitted, and the girl returned to school in the best of health.

Prevalence of Defects.—Defective vision is undoubtedly much more prevalent among the uneducated than some suppose. Ordinary occupations do not reveal the defects and tests are not made, hence we erroneously assume that the defects do not exist. But it is also true that civilization is making demands upon the eye which tend to produce deterioration. This is especially true because hygienic laws are unknown or unheeded. Badly lighted homes, school-houses, and business establishments are responsible for much suffering which the observance of hygienic conditions would obviate. School life is particularly hard on the eyesight. Cohn states that in twenty-four

gymnasien and *realschulen*, containing nearly ten thousand pupils, in sexta (the lowest class), twenty-two per cent. were myopic, while in prima (the highest class), fifty-eight per cent. were afflicted.

Kotelmann says:[1] "Shortsightedness is a defect developed by civilization, since it is never found among savage tribes. I have examined a great many Lapps, Calmucks, Patagonians, Nubians, Somali, and Singhalese, but I have never found a single near-sighted person, either among the children or the adults. Myopia did not exist in New Zealand till it appeared among the natives after the introduction of civilization." Myopia, as previously noted, is more prevalent among civilized peoples than among savages. It also increases from childhood to maturity. While much defective eyesight can be directly traced to heredity,[2] school work unquestionably is responsible for its steady increase with the advancing grades of school life. The following table, taken from Kotelmann's *School Hygiene*, represents typical conditions in German *gymnasien:*

TABLE SHOWING PERCENTAGE OF CASES OF DEFECTIVE VISION IN THE DIFFERENT GRADES OF SOME GERMAN SCHOOLS

CLASSES	Rostock	Giessen	Wiesbaden	Hamburg	Montobaur	Fulda	Königsburg	Frankfort a. M.	Magdeburg I	Magdeburg II	Hamburg (Realschule)
Sexta (lowest)	19	5	23	14	0	16	20	17	23	23	29
Quinta	16	9	25	21	10	20	21	15	27	27	24
Quarta	34	14	32	45	21	20	28	12	42	39	40
Untertertia	35	19	50	40	26	51	44	33	47	63	46
Obertertia	35	24	50	40	19	34	44	41	47	63	16
Untersekunda	40	34	58	48	47	42	54	53	56	58	71
Obersekunda	40	40	58	48	54	71	54	48	56	58	71
Prima	41	43	47	61	40	58	64	50	70	75	50
Oberprima (highest)	41	50	47	61	50	60	62	66	70	75	50

[1] *School Hygiene*, p. 246; English translation by J. Bergström.

[2] Cohn, *Hygiene des Auges*, p. 278.

Myopia is a condition of the eye in which either the eyeball is too elongated or the lens is too convex. In either case the rays of light are brought to a focus in front of the retina. Only near objects can be seen distinctly. Concave glasses help to correct the defect.

Tests.—Because of the alarming prevalence of eye defects among school children, the teacher should be instructed in methods of testing the sight. The purpose is not to assume the rôle of physician, but to discover disturbances and to have serious cases reported to the physician. Pronounced defects should be readily observed by the alert teacher without the aid of specially devised tests. If a pupil squints, habitually holds the book too near the face, wrinkles the brow, complains of headache, or mispronounces words in reading, trouble may be suspected. Such pupils should be watched more closely and questioned concerning their own knowledge of the case. More accurate tests should be applied in all cases that seem abnormal. The simplest test is made by using the Snellen's Test Letters. These consist of letters of varying sizes (see illustration below), which should be plainly seen by the normal eye at the distances indicated on the cards.[1]

SNELLEN'S TEST LETTERS

□ O B R K 5 6

Should be seen easily by the normal eye at a distance of about three metres or ten feet.

Still better than the test letters are the Cohn Test Types, of which the accompanying are illustrations. These are especially desirable because with letters or figures much guessing is possible. A single element of a letter or figure even indistinctly seen may be sufficient to suggest the entire character. With Cohn's types no guessing is possible, and, moreover, children who are unable to read may be tested:

[1] These cards are inexpensive and may be secured at the McIntosh Battery and Optical Company, 521–531 Wabash Ave., Chicago.

COHN'S TEST TYPES

Should be seen easily by the normal eye at a distance of about five metres or sixteen feet.

The mechanical make-up of books is a very important consideration. Only the plainest type should be used. The letters should be large enough to be easily seen, and the spacing between letters and lines should not induce fatigue. A cursory observation will reveal to the thoughtful person whether the page is desirable or not. A few suggestions will, however, be made. The type of school-books for the first grade should be at least 2.6 mm. high, and the width of leading between lines 4.5 mm., as shown in the following:

"Jack and Jill went up the hill,
To get a pail of water.
Jack fell down and broke his crown,
And Jill came tumbling after."

It would be still better if the print read by first grade pupils were as large and legible as the following specimen:

"Pussy-cat, Pussy-cat,
Where have you been?
I've been to London,
To see the queen."

Books used in the second and third grades should have letters at least 2 mm. high and the lines should be at least 4mm. apart. The following specimen is a good model:

"Come, little leaves," said the wind one day;
"Come over the meadows with me, and play.
Put on your dresses of red and gold,—
Summer is gone, and the days grow cold."

The print used in the fourth and following school years should have letters at least 1.8 mm. high, and the space between the lines should be at least 3.6 mm., as shown in the accompanying specimen:

"Harness me down with your iron bands;
Be sure of your curb and rein;
For I scorn the power of your puny hands,
As the tempest scorns a chain."

The length of the line is also very important. Short lines are more easily read and less fatiguing than long ones. Cohn demands that no book be printed with letters less than 1.5 mm. high and with the down strokes .25 mm. thick. The lines should be no longer than 10 cm., or four inches. The question of leading is an important consideration. The heavily leaded lines are much easier to read than those lightly leaded. The difference between the two is seen in the two accompanying specimens:

The President shall be commander-in-chief of the army and navy of the United States, and of the militia of the several states, when called into the actual service of the United States; he may require the opinion, in writing, of the principal officer in each of the executive departments, upon any subject relating to the duties of their respective offices, and he shall have power to grant reprieves and pardons for offences against the United States, except in cases of impeachment.

The President shall be commander-in-chief of the army and navy of the United States, and of the militia of the several states, when called into the actual service of the United States; he may require the opinion, in writing, of the principal officer in each of the executive departments, upon any subject relating to the duties of their respective offices, and he shall have power to grant reprieves and pardons for offences against the United States, except in cases of impeachment.

It is important to have the room and the page well illuminated at all times when reading is done. Diamond type, as shown in the accompanying specimen, should be read without a strain at a distance of twelve inches.

"Sink or swim, live or die, survive or perish, I give my hand and my heart to this vote. It is true, indeed, that in the beginning we aimed not at independence. But there's a divinity that shapes our ends. The injustice of England has driven us to arms; and, blinded to her own interest for our good, she has obstinately persisted till independence is now within our grasp. We have but to reach forth to it, and it is ours. Why, then, should we defer the Declaration?"

There are many other regulations that should be understood and heeded, but the minor ones have been left for special treatises on the subject.[1] Too much emphasis cannot be laid upon the necessity of having good light, well-printed books and maps, the best of blackboards, and rooms with sufficient yet not glaring lights. The child should always be properly placed so that he can see without strain or fatigue. One more point only will be suggested. There is great danger of requiring too much reading and writing of young children. Instruction during the first few years of school life should be mainly oral. The frequent custom of assigning so much book-work, upon which children are to be merely tested, shows pedagogic ignorance. Still more reprehensible is the practice of giving written work for "busy work." It is safe to say that during the first six school years there is five times as much written work as there ought to be. The only way many teachers know how to keep pupils busy is to set them to wagging a pen.

Hearing: Prevalence of Defects.—Although there seems to be considerable variation among the results of different investigations, there is abundant evidence that the percentage of children with defective hearing is large. Many of the variant results are evidently due to differences in means and conditions of testing. The test employed in all cases given below was the

[1] For many additional suggestions see Shaw's *School Hygiene*, chap. 9.

whisper test. There is no uniform standard for whispering, different persons whispering with different degrees of loudness. Much depends also on the words used and the stillness of the room. Each investigator has to establish his own standard from normal cases.[1]

Several well-supported conclusions are apparent in all the results: (1) The number of defects increases from grade to grade. (2) Among the poor and especially among the uncleanly, the percentage is higher than among the well-to-do. (3) The majority of children and many of the teachers were not aware of the defects. In one New York school only one child out of seventy-six defectives was known by the teacher to be afflicted. At Terre Haute, out of ninety-eight defectives the teacher knew of only one. In an orphan asylum, at the same place, two out of twenty-seven were known to the teacher. (4) Usually both ears are not affected to the same extent, though if either is in a very serious condition the other suffers also. (5) Among feeble-minded or generally defective children there are many more with deranged hearing than among normal children. Barr, of Glasgow, estimates that the ratio is two to one. (6) In many cases those with abnormal hearing are classed by their teacher as lazy, absent-minded, inattentive, stubborn, etc. (7) "Gellé also examined with the watch the hearing of pupils in schools of the first order in Paris. He carefully tested those who were lowest in their classes, and were counted dull and bad, and always being punished and scolded. He counted the normal distance for hearing the watch at 1.25 metres. In one school, among seven primary pupils he found only two who could hear the watch at more than a metre with both ears, four heard it with both ears at 50 centimetres and under, and one heard it with one ear at 1 metre, and with the other at 20 centimetres. Among thirteen intermediate pupils, two heard the watch at more than 1.25 metres; five at from 1 to 1.25 metres on one side and at 60 centi-

[1] Most of the facts herein stated concerning defective hearing have been taken from Chrisman's study, "The Hearing of Children," *Pedagogical Seminary*, 2 : 397–441.

metres and below on the other; six at 65 centimetres and below in both ears. This testing was done in the greatest silence. Good cranial perception was noticed in all. All these pupils were noted by their teachers as incapable, unintelligent, disobedient, were frequently punished, and almost always placed last (on the row of seats) for their disobedience. . . . Among twenty of the foremost pupils in four classes in a school, there were but six who heard the watch at less than 50 centimetres, whereas among twenty of the lowest pupils in these same classes, there was not a one that heard the watch at more than 50 centimetres."[1]

Chrisman made a careful analysis and summary of all the important investigations that had been made on the hearing of school children. The following table is largely a reproduction of his table:[2]

TABLE SHOWING DEFECTS OF HEARING AMONG PUPILS IN VARIOUS SCHOOLS

NAME OF INVESTIGATOR	PLACE	DATE	NUMBER EXAMINED	NORMAL DISTANCE	NUMBER DEFECTIVE	PER CENT. DEFECTIVE
Reichard	Riga	1878	1,055		235	22.27
Sexton	New York	1881	570	12 ft.	76	13.33
Weil	Stuttgart	1882	5,905	15 m.	1,855	31.22
Worrell	Terre Haute	1883	491	15 ft.	125	25.49
Gellé	Paris	1883	1,400	8 m.	.....	20 to 25
Moure	Bordeaux	1884	3,588	15 m.	616	17.15
Bezold	Munich	1885	.....	.....	495	25.8
Von Gossler	Prussia	1885	.....	.....	.....	2.18*, 1.80†
Lunin	St. Petersburg	1888	281	16 m.	55	19.5
Zhermunski	St. Petersburg	1888	‡W. 1,897 P. 1,680	12 m.	W. 317 P. 222	W. 16.7 P. 13.17
Barr	Glasgow	1889	600	.....	166	27.66
Schmiegelow	Copenhagen	1889	581	4m.	§I 35 II 261	I 6.02 II 44.9

* Higher schools. † Lower schools.
‡ W = whisper test. P = Pulitzer's acoumeter. § I = below 2 metres. II = between 2 and 4 metres.

It is even more true of hearing than of sight that defects may exist unknown to the individual afflicted. With children it is very difficult to discover deficiencies. Even experts have difficulty in determining. Many people have become stone deaf in one ear without realizing it. Still more frequently great

[1] Chrisman, *Op. cit.*, 2 : 407–408.

[2] *Op. cit.*, p. 437.

dulness may exist without being detected. Parents and teachers usually do not discover the hearing defects in children until they assume an aggravated form. The misunderstandings due to defective hearing are more often attributed to inattention, disobedience, or stupidity. The two former verdicts are frequently rendered especially when the child has one good ear. When the other ear is toward the teacher and misunderstandings or disobedience occur the teacher is sure that it is the child's fault, inasmuch as on some other occasions obedience ensues. This suggests the extreme necessity of making frequent tests upon school children.

Tests for Deafness.—It is important for teachers and parents to understand how to make simple untechnical tests of the hearing of children. The purpose should not be to displace the medical specialist. On the contrary, the teacher and the parent should simply seek to prevent as many diseases as possible and be intelligently alert in their discovery. Once disease is suspected, more accurate observations and tests should be instituted for the purpose of confirming or allaying suspicion. If a pupil is dull, listless, inattentive, or a mouth-breather, notice carefully whether he can hear what is said to him. This can generally be determined by speaking in a low voice, especially with the lips screened from his view. This last is necessary because many deaf become exceedingly expert lip-readers. The whisper test is recommended by many as very efficient. A standard must be established by testing several persons. It is not absolutely reliable, because of the difficulty of standardizing the voice. Again, through apperception the subject may guess much by detecting a single syllable. It is well to use a variety of words to see if there may be some special type of sound-blindness. Dr. Blake, a famous Boston aurist, gave the following test-words in a grammar school: Cat, dog, fan, few, long, land, log, pen, pod. Many other words were given back instead of the test words. "The words used for pod were: Hove, hoe, hawk, hoved, hoad, hoge, hart, half, hard, hope, hub, hark, hood, pawd, parg, palm, pant, paw, parm,

pok, pout, pard, bong, cot, tod, of—each once; heart, hug, prove, papa, dod, long, tog—each twice; hollow, path, pot, pob, pop, log, pual—each three times; hot, cod, pug—each four times; have, pond—each five; fog, six; park, ten; hard, twenty-five; pog, twenty-six; hod, thirty-six; hog, eighty-five."[1] These tests are very suggestive concerning the teaching of spelling also.

A more accurate test is the watch test. The room should be absolutely quiet, and a standard determined by testing several normal persons under the given conditions. The child tested should not see the watch or his imagination will lead to error. The test should be made by gradually bringing the watch toward each ear (the other ear being stopped), and then by slowly removing the watch from the ear. The distance depends much upon the watch and other conditions. The most accurate test known is that made by the use of Seashore's audiometer. This consists of an instrument possessing an induction coil, a dry battery, a galvanometer, a resistance coil, switches, and a telephone receiver, which produce and convey to the ear a definitely graded series of tones. These are controlled by merely adjusting keys which make electrical connections.[2]

All cases of deafness found among school children should at once be reported to parents, who in turn should consult a specialist. A large percentage of cases will yield to treatment if discovered in time. All school children ought to be examined about once a year. The tests would not take long to make. If not all are tested the teacher should be on the watch for cases, and those suspected should be thoroughly examined.

Causes: Hygienic Suggestions.—There are many causes of deafness, a few of which will be mentioned. First, there are the hereditary predispositions. Fay is authority for the statement that "brothers and sisters of the deaf are found to be deaf in

[1] Chrisman, *Op. cit.*, p. 428.

[2] Seashore, "Suggestions for Tests on School Children," *Educational Review*, 22 : 69–82.

twc hundred and forty-five cases out of one thousand. Where both parents are deaf the children are two hundred and fifty-nine times as likely to be deaf as when both parents are normal."[1] Many children are born deaf in varying degrees from slight dulness of this sense to total deafness. Not a few cases of considerable deafness are undiscovered for months and even years. When there is a hereditary predisposition through scrofulous affections a great many conditions may arise to induce deafness. Chief among these are such childhood diseases as measles, scarlet-fever, whooping-cough, cerebro-spinal-meningitis, diphtheria, mumps, etc. Colds in the head, which are so lightly regarded by many, are apt to develop into chronic conditions of inflammation. The congested membranes may press upon the eustachian tube or prevent sufficient air from entering the middle ear. Reichard claims that of all causes of defective hearing this heads the list. All catarrhal diseases producing hypertrophied conditions of the nose and throat cause multitudes of cases of disturbed hearing. Adenoid growths often result, which press upon the eustachian tube, fill the nasal passages, or otherwise obstruct the breathing. The mouth-breather should always be examined carefully, as conditions quite likely exist which demand immediate attention. Enlarged tonsils are a frequent cause of deafness. Adenoids and enlarged tonsils usually accompany each other. They are of surprising frequency. One physician informed me that he had operated upon one thousand two hundred cases in eight years. How many more must have been suffering from the same causes! It is of vast importance to have the specialist remove these growths, thus usually relieving the deafness. If attended to before adolescence the cure is usually complete. If postponed until later, for some unknown reason, cures are much less frequent. If present in infancy, adenoids sometimes develop such alarming proportions as to press upon the brain and produce idiocy. Undoubtedly many children might have been saved to society had they received the attention of the specialist early enough.

[1] *Marriage of the Deaf in America*, p. 49.

CHAPTER XII

INDIVIDUAL VARIATIONS AND DIFFERENCES

General Considerations.—There are few who would not admit that among people there are many obvious differences of physical structure, and that these differences are natural. But when mental qualities are considered it is at once assumed that all are alike or would be if educated alike. Teachers even are apt to think that all the intellectual differences among children can be accounted for by differences of diligence, willingness to work, application, etc. They will even admit temperamental differences to account for differences of application, but tacitly assume that intellectually "all men are created equal." No greater fallacy ever existed. No two individuals were ever exactly alike, physically, mentally, or morally. Occasionally a pair of twins seem almost indistinguishable, but careful study of them always reveals large differences.

The organic world reveals great differences among individuals of the same species. In the plant world it would be impossible to find two leaves, two blades of grass, or two plants absolutely alike. Some slight differences serve to give each its individuality. In turning to human beings we shall not find it difficult to discover abundant cases of individual variations. There are the giants and the dwarfs, the tall and the short, the blondes and brunettes, beautiful and ugly, black and white, good and bad, choleric and phlegmatic, brilliant and stupid, blue-eyed and brown-eyed, and other extremes too numerous to chronicle. Between these extremes there are all grades and shades of apparent difference. Besides these obvious differences there are innumerable variations which are not so apparent and hence

thought not to exist. Some persons burst forth into song with the most meagre training, while others, with the best masters, could never carry a tune or discover discord; some are ready spellers, while many others are hopeless; some are born mathematicians, while others never can progress beyond the merest rudiments. One child early exhibits mechanical genius, devising appliances for every sort of work, while another can never learn to put together the simplest contrivance; one can memorize verbatim with the greatest ease, while another can never repeat a quotation; one person picks up the pen and without training begins to produce literature, while another cannot chronicle accurately the simplest event; one mounts the platform and charms the multitude with his eloquence, while another is made mute in the presence of an audience. Although all human beings possess the same general faculties, yet there are wonderful differences of development among individuals and also between the lowest and the highest as a class. Even zoologically there are notable developmental differences. Fiske remarks[1] that: "The cranial capacity of the European exceeds that of the Australian by forty cubic inches, or nearly four times as much as that by which the Australian exceeds the gorilla; and the expansion is almost entirely in the upper and anterior portions."

Anatomical Variations.—Anatomists inform us that there is great variability in all parts of man's structure. Many organs are atavistic in nature and approximate the structures of other animals. The arteries are so variable that surgeons have found it necessary to determine the probable proportion of each variation. The point of decussation of the brachial artery sometimes varies five or six inches. Occasionally the branching takes place at so high a level as to make the artery appear double. The position of the heart varies so much that in occasional cases it is transposed from the left to the right side of the body. This condition is usually associated with a general transposition of the viscera and the possession of a right instead of a left aortic arch. The internal structure of the heart varies greatly

[1] *Destiny of Man*, p. 48.

among individuals.[1] An occasional person has all double teeth, others have double rows of teeth. Wallace reports[2] that muscles are so variable that in fifty cases studied no two were alike. In thirty-six cases no fewer than five hundred and fifty-eight variations were found. In a single male subject seven muscular variations atavistic in character were observed. "Autopsies have shown that in right-handed persons the speech centre is placed or is functional usually in the left cerebral hemisphere, while in the case of left-handed individuals aphasia and paralysis are produced by lesions involving the right side of the brain." [3]

Wiedersheim is authority for the statement that there are such great individual differences of development of the muscular system that new muscles, not catalogued in the text-books, can be found in nearly every person. These variations are retrogressive and vestigial, occasional, or atavistic; and progressive or newly developing structures. Donaldson tells us that among brains, as in the case of all organs called similar, there are very numerous and wide variations. The statistics on the brain weights of eminent men and the discussion of the relation between body and mind show this very clearly. Thackeray's brain, weighing 1,644 grams, is the heaviest recorded; while Tiedemann, the great anatomist, equally as great in intellect, possessed a brain weighing only 1,254 grams. Not only are there great variations in size and weight, but also in structure.[4] In measuring height sitting and standing, "Zeissing found individual differences here so great that the proportions of some children at four were like those of others at fourteen." [5] The finger prints of each person are so unique in character that they are as certain a means of identification as a photograph. This method is so accurate that it has been used to some extent in identifying and in tracing criminals. It has also been used in banks as a means of identifying depositors, being much more conclusive than

[1] See Cunningham's *Text-Book of Anatomy*, pp. 946–956, for many interesting cases of variations.

[2] *Darwinism*, p. 447.

[3] Howell, *Text-Book of Physiology*, p. 216.

[4] *Growth of the Brain*, p. 134.

[5] Hall, *Adolescence*, I, p. 61.

handwriting. Although the size of the finger prints enlarges from childhood to maturity, the arrangement never changes and duplicates do not exist.

Athletic promoters often argue that athletic training can develop stars out of weaklings. Real trainers know better, but the public is often made to believe the alleged virtues. Star athletes are not made, they are born just as poets are. No one without athletic power, latent or apparent, ever developed into a star on the athletic field. The great majority would never be able to make a hundred-yard dash in ten seconds though they should "work out" every day of their school life. Others are acknowledged sprinters without a day of training. Superintendent Reed took a series of measurements of his high-school boys, and they discovered that only those with arms of certain proportions could throw a ball well. Others might try hard, but could never succeed. Nature had determined these matters long before. Tests in simple reaction times show variations from .125 of a second to .250 of a second. No amount of practice materially changes the individual's norm.

Variations in Sensitivity.—There are very striking individual differences in sensitivity. Ribot reports[1] that Lapps take tobacco oil for colic and that their skins are as insensitive as are their stomachs. Montesquieu says that in Lapland you must flay a man to make him feel. Ribot cites many cases of persons who have hypersensitivity to either heat or cold. Some persons, as we all know, are so sensitive to tickling that the slightest touch may produce syncope. Point a finger at some children and suggest tickling and they are so hypersensitive that they almost go into spasms. Others are wholly insensible to it. Mosso tells us that if different persons are exposed to cold "one takes inflammation of the lungs, another tetany, a third facial paralysis, a fourth rheumatism, a fifth enteritis, a sixth a simple chill, a seventh some disease of the skin, and the others no harm at all. It is the same with intellectual fatigue."[2]

[1] *Heredity*, p. 37.
[2] *Fatigue*, p. 220.

Variations in Mental Characteristics.—The mental processes of different people have their special characteristics, although this is scarcely suspected by the popular mind. Some are ear-minded, some eye-minded, others motor-minded. Some persons think in abstract terms very early, while others never get to the point of doing abstract thinking, but must have everything in the concrete. Darwin tells us that he does not believe he ever would have made a mathematician or a lawyer, because he found it difficult to carry on a long train of abstractions. He had a marvellous mind for the concrete. Some pupils succeed famously with arithmetic and algebra, but utterly fail in geometry. A diagnosis of their types of imagery would doubtless reveal inability to visualize. Such persons would never make architects or inventors. Some children begin to walk at six or seven months, others not until three times that age. Some children can talk readily at twelve months, while I have known a bright boy to defer this process until four years of age. One record chronicles a list of twelve hundred words at two years of age. Many do very little talking before two years. There are adult manual laborers of ordinary intelligence who do not have a usable vocabulary exceeding two or three thousand words. Many scholars use from thirty to thirty-five thousand and recognize as many more.

Tests Revealing Differences in Memorizing.—It is very obvious that there are very great differences in the results obtained by different persons who attempt to memorize. These differences in results are undoubtedly due (*a*) to differences in native ability, and (*b*) to differences in methods of memorizing. To a teacher who has not thought of the matter the carefully recorded results of a test in memorizing would be very suggestive, possibly almost incredible. Many teachers are in the habit of assigning the same work to an entire class, and really expect that the results obtained should be very uniform. If accurate records are not kept the teacher may even think that the results are tolerably uniform. One of my students, a grade teacher, assigned twenty poems to a third grade and a fourth grade, to be memor-

ized under uniform conditions. She kept a record of the progress, which is shown for the fourth grade in the accompanying table. The table for the third grade revealed exactly the same kind of variations in results. The numbers from 1 to 20 at the top of

TABLE SHOWING INDIVIDUAL VARIATIONS IN A MEMORIZING TEST

FOURTH GRADE

NAME	AGE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Mary	11	x	x	x	x	x	x			x	x	x	x	x			x	x			x
Ruth	8	x	x	x		x					x	x	x								
Irene	9	x	x	x	x	x	x			x		x									x
Helen	8	x	x	x	x	x	x	x	x	x	x	x	x	x			x		x	x	x
Winnie	9	x		x									x								
Dan	9	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Howard	11	x		x	x	x	x				x	x		x							x
Raymond	9	x		x		x															
Omer	9	x		x		x					x										
Walter	9	x	x	x	x	x	x	x				x		x							x
Bennie	12	x		x	x	x	x	x													
Levern	8	x	x	x	x	x	x	x	x	x	x	x	x	x				x	x		x
Earl	10	x		x		x															
Homer	9	x	x	x	x	x	x	x			x		x		x			x			
Joe	10	x		x	x		x														
Albert	9	x		x		x	x														
John	9	x	x	x	x	x	x	x		x	x	x		x		x		x	x		x
Bessie	12	x		x		x															
Oscar	10	x		x		x															
Florence	13	x	x	x	x	x															
Mary E.	11			x		x															

the table indicate the numbers of the poems. The check marks indicate the ones learned up to a given time when the contest ended. The results, be it remembered, are given here not to show differences in ability. They simply indicate differences in accomplishment. Probably there were some slight variations in the amounts of time devoted to the exercise, although that was

closely guarded. Undoubtedly there were very great differences in diligence. But the point to be made is, that here was some measurable work assigned to a class under conditions even more uniform than those attending the preparation of ordinary school lessons, and the results vary from almost nothing accomplished to perfect results. The teacher informed me that those who accomplished the least probably worked the hardest. The results of this test were quite in harmony with the attainments of the same children in memorizing other lessons. The teacher believed that the results indicated real native differences in ability. I feel sure that such was the case, although proof would need to come from other tests.

Conditions Determining Grade.—In the chapter on the relation between mind and body it was shown emphatically that a great many school children are below normal physically in some particular or other. In some schools from twenty per cent. to sixty per cent., according to grade, suffer from defective eyesight, and from five per cent. to twenty per cent. have defective hearing. Add to these the many cases of chronic diseases, deformities, and temporary ailments, contagious diseases, disturbances from bad ventilation, ill-adjusted seating, lack of sleep, overwork, etc.

Variations in School Ages.—Dr. Search made a study of the ages of school children in a Massachusetts town and discovered great variations from the normal. His table showing the number of pupils of given ages in each of the grades is very

TABLE SHOWING THE NUMBER OF PUPILS OF DIFFERENT AGES IN TWO SCHOOL GRADES [1]

AGE	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
No. in 4th Grade	11	85	178	139	96	61	56	24	2	3						
No. in High School, First Year							9	50	63	73	40	13	6	1		1

suggestive. A part of that table is reproduced below. Superintendent Johnson, of Decorah, Iowa, who carried out an investigation under my direction, found twelve-year-old children

[1] From Search, *An Ideal School*, p. 19.

in every grade from the first to the ninth inclusive. Dr. Search even found thirteen-year-olds in every grade from the first to the tenth, and fourteen-year-olds in every grade from the second to the eleventh. He even reports a sixteen-year-old in the first grade, and several of them in the fourth.

Differences Revealed by Individual Measurements.—If a systematic study were made by a teacher of the individual differences

TABLE SHOWING INDIVIDUAL VARIATIONS AS REVEALED BY PHYSICAL MEASUREMENTS AND SCHOOL GRADES [1]

	1st yr. Boys		1st yr. Girls		4th yr. Boys		4th yr. Girls	
Ages	MIN. 13.9	MAX. 17.8	MIN. 11.0	MAX. 17.0	MIN. 18.0	MAX. 19.7	MIN. 17.3	MAX. 19.6
Height standing	60.0	70.9	58.6	65.8	63.9	72.0	60.9	66.7
Height sitting	30.5	36.5	30.5	34.0	33.0	37.5	30.5	34.5
Weight	105.0	145.0	72.0	145.0	130.0	160.0	95.0	125.0
Arm span	60.0	75.0	55.0	68.0	61.7	72.5	53.5	67.0
Arm length	25.0	31.0	24.0	28.0	24.7	31.0	23.5	28.0
Chest Meas. (a) Normal	28.0	34.0	25.0	35.0	32.0	36.0	28.0	32.0
(b) Expanded	29.5	37.0	28.5	36.0	33.0	40.0	31.0	33.5
(c) Contracted	26.0	31.5	24.0	31.5	31.0	34.5	27.0	31.5
Head (a) Circumference	20.7	22.5	20.2	22.5	21.5	22.4	21.5	23.0
(b) Length	11.5	13.5	11.0	14.5	8.0	12.5	11.5	13.0
(c) Width	6.0	6.7	5.5	7.0	6.0	7.0	5.5	7.0
Length of face	6.7	8.2	7.0	8.5	7.5	8.5	7.2	8.0
Class Standing (a) English	78.0	95.0	79.0	96.0	82.0	90.0	86.0	95.0
(b) Algebra	81.0	93.0	82.0	95.0	81.0	94.0	80.0	90.0
(c) Latin	78.0	95.0	65.0	94.0	no boys	taking	86.0	93.0
(d) Botany	80.0	96.0	78.0	95.0	...	...	...	...
(e) Physiology	77.0	93.0	76.0	95.0	...	...	...	...
(f) Phys. geography	58.0	94.0	70.0	96.0				
(g) Physics	...	...	...	...	83.0	93.0	80.0	90.0
(h) History	...	...	...	...	83.0	94.0	83.0	93.0

[1] Measurements are indicated in inches, weights in pounds. The grades are in per cents.

of physical, intellectual, emotional, and moral qualities of the members of a given class, the results would frequently astonish. The members of a class who are hypothetically on an equality in every respect, who are to be instructed alike, and who are expected to attain similar results, in reality begin with very diverse individual equipment, and will end their work similarly. That they are alike or should be treated alike, is a pure fiction.

A study including some of the points suggested above was made at my suggestion by Superintendent Reed, of Odebolt, Iowa, of the pupils in his high school. The accompanying table summarizes the results. One needs to notice but a few of the items to be impressed with the great differences between maximum and minimum attainments. In age there were from 1.7 to 6 years' difference between members of the same class; in height from 6 to 10.9 inches; in weight from 30 to 73 pounds; in chest measurement from 4 to 6 inches; in length of head from 1.5 to 4.5 inches. The differences between the maximum and minimum attainments in school grades are equally striking. The smallest difference between the maximum and the minimum is five per cent. and the greatest is thirty-six per cent. The variations in class markings do not exhibit as wide deviations as I am confident would be found in many high schools, because the particular school was especially well graded on the basis of individual ability.

A little consideration should serve to recall the fact that there is nothing else in the universe so plastic and modifiable as mind. Consequently we should be prepared to recognize individual differences among minds. These mental differences are far more pronounced than any physical characteristics. Two persons may be strikingly similar in height, weight, carriage, and facial features, and yet be so dissimilar in mental acumen, disposition, ideals, aspirations, and character that one of them does not even remind us of the other. Listen to Mosso on this point: "Even at birth men are physiologically diverse. However far we look back into the mists of antiquity, there are found men who toil for a bare living, and men who to increase their own

enjoyment of life cause others to toil. Even if a law were to place all men in the same conditions, it would be immediately broken, seeing that a law could never be stronger than nature; and society would at once be disorganized once more owing to the different dispositions received by men at birth. . . . Circumspection, perseverance, prudence, temperance, adaptability, and alertness of mind are not gifts which nature has bestowed on all men, and he who is born with them will know how to make himself obeyed. The disappearance of social differences is unfortunately a dream still more beyond our reach than the universal brotherhood of nations." [1]

Holmes remarks in the *Autocrat* that "men often remind me of pears in their way of coming to maturity. Some are ripe at twenty, like human Jargonelles, and must be made the most of, for their day is soon over. Some come into their perfect condition late, like the autumn kinds, and they last better than the summer fruit. And some, that, like the Winter-Nelis, have been hard and uninviting until all the rest have had their season, get their glow and perfume long after the frost and snow have done their worst with the orchards. Beware of rash criticisms; the rough and astringent fruit you condemn may be an autumn or a winter pear, and that which you picked up beneath the same bough in August may have been only its worm-eaten windfalls. Milton was a Saint-Germain with a graft of the roseate Early-Catherine. Rich, juicy, lively, fragrant, russet-skinned old Chaucer was an Easter-Beurré; the buds of a new summer were swelling when he ripened."

Maudsley wrote: [2] "Perhaps of all the erroneous notions concerning mind which metaphysics has engendered or abetted, there is none more false than that which tacitly assumes or explicitly declares that men are born with equal original mental capacity, opportunities and education determining the differences of subsequent development. The opinion is as cruel as it is false. What man can by taking thought add one cubit either to his mental or to his bodily stature? Multitudes of human

[1] *Fatigue*, p. 174.

[2] *Body and Mind*, p. 43.

beings come into the world weighted with a destiny against which they have neither the will nor the power to contend; they are the step-children of Nature, and groan under the worst of all tyrannies—the tyranny of a bad organization. Men differ, indeed, in the fundamental characters of their minds, as they do in the features of their countenances, or in the habits of their bodies; and between those who are born with the potentiality of a full and complete mental development under favorable circumstances, and those who are born with no innate capacity of mental development, under any circumstances, there exists every gradation. What teaching could ever raise the congenital idiot to the common level of human intelligence? What teaching could ever keep the inspired mind of the man of genius at that level?"

Variations in Examination Papers.—In a set of examination papers in a large high school there is always exhibited a great range of attainments. If the highest is marked 100 per cent., the lowest doubtless will be less than 60 per cent., and often not higher than 25 per cent. Often there will be pupils who merit more than 100 per cent., that is, they considerably surpass any excellence which we may rightfully expect. In marking a set of papers of average difficulty some individual papers ought to be above 100 per cent. The marks of 100 per cent. or A, or Excellent, ought to mean not absolute marks, but that point in our scale which represents the best that may be expected on the basis of standards determined for the given grade of pupils or kind of work. For example, a first-grade pupil might be marked 100 per cent. in penmanship, but an eighth-grade pupil doing the same kind of crude writing ought to be marked about 25 per cent. In large classes several will accomplish more than 100 per cent. by outside reading, by more vigorous thinking, and because of natural capacities. In colleges it is quite usual to mark some students A+.

Thorndike says: [1] "The amount of difference actually found in children of the same age or in children in the same school

[1] *The Principles of Teaching*, p. 71.

grade is greater than teachers perhaps realize. The range of ability in school children of the same age is such that in a majority of capacities the most gifted child will, in comparison with the least-gifted child of the same age, do over six times as much in the same time or do the same amount with a sixth as many errors. . . . If the best speller of a class can spell correctly such words as fatiguing, appreciate, delicious, guarantee, triumph, and accident, the worst speller will barely spell such words as house, dollar, potato, present, severe, and praise.[1] If the weakest pupil of a class in computation can do five examples in ten minutes, the best pupil will probably do at least twenty. Roughly speaking, the teacher of a class, even in a school graded as closely as is possible in large cities where two classes are provided in each building for each grade and where promotion occurs every six months, will find in the case of any kind of work some pupil who can do from two to five times as much in the same time or do the same amount from two to five times as well as some other pupil. The highest tenth of her class will in any one trait have an average ability from one and three-fourths to four times that of the lowest tenth," and we readily see that there must be a constantly varying deviation from normal conditions and averages.

Again, many pupils in the schools have undesirable home conditions under which to do their work. Probably few have a room properly heated, ventilated, and lighted, adequate desk room, or freedom from disturbance. Many are under special emotional tension because of straitened pecuniary circumstances, sorrow in the family, ill-treatment, premature love affairs, undue social life, real or imagined ill-health, and a great variety of other causes. All of these factors affect the working capacity of the pupil and materially influence the amount and quality of work accomplished. The wise teacher will recognize that there are influences constantly operative in affecting results. Before passing judgment causes and motives will be investigated.

[1] Thorndike appends the examination papers of two pupils of the same class. A spelled correctly all except one word out of twenty, while B missed all except one.

Fewer cases will be measured by inflexible rules, and more and more will individual cases be evaluated on their merits.

The school should not only give opportunities for dull and delinquent children, but equal opportunities for precocious and earnest ones. Not only are there many subnormal children in every school, but there are many hypernormal — those with potential qualities which only await development to make them the illustrious of their time. As a matter of fact, undue proportions of energy and time are given to the lame and the lazy. Much solicitude is given to finding ways and means of helping the slow, while little thought is given to special ways of providing for those who can easily forge ahead. It is usually the slow pupil who is given most of the time in recitation (except when visitors are present); the slow one who is kept after school to be helped; the slow one over whose papers the teacher burns the midnight oil. The bright one recites quickly, asks few time-consuming questions, easily finds occupation for himself, is seldom selected for extra work, and is a joy forever to his teacher. But how frequently he becomes restive because of the lock-step which he must keep, the time consumed with the slower, and the consequent narrowing of instruction. The result is that frequently such pupils become dissatisfied—they know not why—and either make a dash for liberty, become chronic sources of annoyance, or learn to meekly submit and become dawdlers. Dr. Search has shown[1] that children often drop behind a grade, but seldom skip one. "The opportunity to drop behind the class is always an individual opportunity; the opportunity to get ahead is almost always limited by class environment. Between these two kinds of opportunity there is an abysmal difference. As schools usually go, it is ten times harder for a pupil to gain a grade than to lose one; ten times harder to rise than to fall. Never until the school is built fundamentally for the individual will this element of loss disappear."

Formative vs. Reformative Education.—The public mind is not sufficiently alert to the importance of formative versus

[1] *An Ideal School*, p. 21.

reformative education. Of course, the destitute, crippled, blind, and vicious should ever receive sympathy and aid from those more fortunate. We should minister most wisely to their every need; we should heal their infirmities; we should educate them into self-support and reclaim them to society if possible; but it should also be understood, as Horace Mann stated, that in education one former is worth a thousand reformers. There is absolutely no question that a dollar spent in formative educational means under desirable conditions will obviate the necessity of spending a thousand for reformation. A careful diagnosis of educational agencies is showing very clearly that one prominent reason why so many pupils withdraw from school long before they have exhausted its resources and before they have become self-supporting is because the schools do not amply minister to the widely divergent wishes and needs of all the pupils.

From the time of its organization to 1899 the State of Iowa[1] had paid for the equipment and maintenance of its two penitentiaries, \$4,019,715; for its four hospitals for the insane, \$11,899,143; for the two reform schools, \$1,765,624; for the institution for the feeble-minded, \$2,205,175; and for the blind, deaf and dumb, and other unfortunates, enough to bring the total sum expended by the State for its criminals and unfortunates, to \$24,104,101. During the same period the State had appropriated for her university, her normal school, and her college of agriculture and mechanic arts, \$3,703,678. That is to say, the State had paid about seven times as much for the care, education, and reformation of her unfortunates as for the education of her intellectual élite; seven times as much for those at the foot of the ladder as for those at the top. Should not the proportions be reversed? If the State should contribute to the education of her choicest in the exact measure that they could make use of it, would not the proportion be reversed? When we stop to realize the importance to society of the leaders among men can we doubt the wisdom of training them to the highest possible

[1] Iowa is taken as an illustration because the figures are accessible.

efficiency? In business it is recognized that the great manager is worth as much to the business as scores or even thousands of ordinary workmen. Is the same not true of society? The worth to civilization of a Shakespeare, a Mozart, a Pasteur, an Edison, a Horace Mann, a Washington, a Lincoln, a Thomas Arnold, cannot be adequately computed in quantitative terms, but has each one not been of infinitely greater value to society than ten thousand who have simply vegetated?

It is certain also that a liberal increase in expenditures for education would greatly decrease the amounts necessary for the care of the unfortunate. Intelligence reduces disease, pestilence, poverty, and crime. The great army of unfortunates are largely the victims of their own ignorance or of the ignorance and iniquity of the fathers visited upon the children unto the third and fourth generation. The discoveries of Darwin, Pasteur, Jenner, and their disciples have made it possible to almost stamp out small-pox, diphtheria, scarlet-fever, and a host of other infectious diseases. The researches and sacrifices of Lazear and Reed have made it possible to almost eliminate yellow-fever. Milk inspection and the enforcement of sanitary precautions are saving thousands of babes annually in our metropolitan centres. A higher standard of intelligence and the enforcement of higher ethical principles in marriage would largely eliminate the blind, the deaf and dumb, the insane, criminals, and paupers. Higher intelligence and higher ethical standards are just what schools stand for.

School Attendance.—Children drop out of schools in great numbers because the schools do not offer what they demand, and often really need. The growth of second-rate business colleges demonstrates clearly that the public schools are failing to provide a certain type of instruction which the people demand. If this is not to be had under desirable auspices, it will be obtained in the only way left. The development of private trade-schools, manual-training schools, and technological institutions is evidence that certain classes of people demand an education that looks more directly toward vocations in which their chil-

dren are certain to engage. The lack of such training in the public schools has driven thousands from its doors, and the lack of means to secure it at private expense has driven the boys and girls to work under unwholesome conditions or, still worse, to the streets. In either case, they are surrounded by immoral influences. From these classes most of the recruits in crime are derived. Is it not time that the public awoke to the need of preventive protection? Judge Lindsey, of the Denver Juvenile Court, who has studied so closely the causes of juvenile delinquency, is certain that the lack of vocational education is one of the most prolific sources of crime. He pointedly remarks that "the only place in the United States where a boy can learn a trade at public expense is in the reform school!" This is a sad commentary. The public school should be made to fit the children, and not the children to fit the school.

Education a Means of Revelation and Adjustment.—President David Starr Jordan, through his vigorous utterances from Stanford University, has been doing much toward the reorganization of schools. He says: "There is no virtue in educational systems unless the systems meet the needs of the individual. It is not the ideal man or the average man who is to be trained; it is the particular man as the forces of heredity have made him. His own qualities determine his needs. 'A child is better unborn than untaught.' A child, however educated, is still untaught if by his teaching we have not emphasized his individual character, if we have not strengthened his will and its guide and guardian, the mind. . . . All education must be individual—fitted to individual needs. That which is not so is unworthy of the name. A misfit education is no education at all. . . . Higher education has seemed to be the need of the few because it has been so narrow. It was born in the days of feudal caste. It was made for the few. . . . The rewards of investigation, the pleasures of high thinking, the charms of harmony, were not for the multitude. To the multitude they must be accessible in the future. . . . If we are to make men and women out of boys and girls, it will be as individuals, not as classes. The best field of

corn is that in which the individual stalks are most strong and most fruitful. Class legislation has always proved pernicious and ineffective, whether in a university or in a state. The strongest nation is that in which the individual man is most helpful and most independent. The best school is that which exists for the individual student." [1]

President Eliot, in his admirable article, "The Function of Education in Democratic Society," has said: "Another important function of the public school in a democracy is the discovery and development of the gift or capacity of each individual child. This discovery should be made at the earliest practicable age, and, once made, should always influence, and sometimes determine, the education of the individual. It is for the interest of society to make the most of every useful gift or faculty which any member may fortunately possess; and it is one of the main advantages of fluent and mobile democratic society that it is more likely than any other society to secure the fruition of individual capacities. To make the most of any individual's peculiar power, it is important to discover it early, and then train it continuously and assiduously. It is wonderful what apparently small personal gifts may become the means of conspicuous service or achievement, if only they get discovered, trained, and applied. . . . In the ideal democratic school no two children would follow the same course of study or have the same tasks, except that they would all need to learn the use of the elementary tools of education—reading, writing, and ciphering. The different children would hardly have any identical needs. There might be a minimum standard of attainment in every branch of study, but no maximum. The perception or discovery of the individual gift or capacity would often be effected in the elementary school, but more generally in the secondary; and the making of these discoveries should be held one of the most important parts of the teacher's work. The vague desire for equality in a democracy has worked great mischief in democratic schools. There is no such thing as equality of gifts, or powers, or faculties

[1] Jordan, *Care and Culture of Men*, pp. 66–71.

among either children or adults. On the contrary, there is the utmost diversity; and education and all the experience of life increase these diversities, because school, and the earning of a livelihood, and the reaction of the individual upon his surroundings, all tend strongly to magnify innate diversities. The pretended democratic school with an inflexible program is fighting not only against nature, but against the interests of democratic society. Flexibility of program should begin in the elementary school, years before the period of secondary education is reached. There should be some choice of subjects of study by ten years of age, and much variety by fifteen years of age. On the other hand, the programs of elementary as well as of secondary schools should represent fairly the chief divisions of knowledge, namely, language and literature, mathematics, natural science, and history, besides drawing, manual work, and music. If school programs fail to represent the main varieties of intellectual activity, they will not afford the means of discovering the individual gifts and tendencies of the pupils." [1]

Search says:[2] "The child of a king, plus heredity, plus environment, stands at the door of the school and knocks, asking for that which uniformity can never give. Before the teacher, frequently of limited horizon and questionable motive, there gather in the school fifty children. Whence came they? They are the children of God, born of modifying parentages and conditioned by an evolution which knows no uniformity. In sizes, weights, temperaments, physical health, responsibilities, capabilities, and opportunities, what a heterogeneous assemblage! Side by side, in the same school, sit the children of wealth and of poverty, of native and of foreign descent, the well-fed and the meagrely nourished, the warmly clad and the scantily protected from the storm, the refreshed by adequate sleep in rooms of pure air and those worn from meagre hours of rest in a crowded, unventilated room, the child of luxury and the one of heavy responsibilities, the spoiled by indulgent parents and the indepen-

[1] *Educational Reform*, p. 408.

[2] *An Ideal School*, p. 160.

dent through forced self-reliance, the robust in physical health and the incapacitated by past sicknesses and injuries, the well-taught and the ill-taught, the child of virtue and the one whose whole life is a moral struggle, the child of encouragement and ambition and the one heart-sick and of little expectancy. Is this an exceptional school? If not, what are the individual rights of these children? How can any system of uniformity answer the responsibility which it assumes?"

Burbank, the botanical wizard, considers differentiation as absolutely necessary and unavoidable. He says:[1] "Right here let me lay special stress upon the absurdity, not to call it by a harsher term, of running children through the same mill in a lot, with absolutely no real reference to their individuality. No two children are alike. You cannot expect them to develop alike. They are different in temperament, in tastes, in disposition, in capabilities, and yet we take them in this precious early age, when they ought to be living a life of preparation near to the heart of nature, and we stuff them, cram them, and overwork them until their poor little brains are crowded up to and beyond the danger line. The work of breaking down the nervous systems of the children of the United States is now well under way. . . . It is imperative that we consider individuality in children in their training precisely as we do in cultivating plants. Some children, for example, are absolutely unfit by nature and temperament for carrying on certain studies. Take certain young girls, for example, bright in many ways, but unfitted by nature and bent, at this early age at least, for the study of arithmetic. Very early—before the age of ten, in fact—they are packed into a room along with from thirty to fifty others and compelled to study a branch which, at best, they should not undertake until they have reached maturer years. Can any one by any possible cultivation and selection and crossing compel figs to grow on thistles or apples on a banana tree?"

President Eliot says:[2] "Uniformity in intellectual training

[1] "The Training of the Human Plant," *Century*, 72 : 127–138.
[2] Hinsdale, *Studies in Education*, p. 123.

is never to be regarded as an advantage, but as an evil from which we cannot completely escape. . . . All should admit that it would be an ineffable loss to mankind if the few great men were averaged with the millions of common people—if by the averaging process the world had lost such men as Faraday and Agassiz, Hamilton and Webster, Gladstone and Cavour. But do we equally well understand that when ten bright, promising children are averaged with ninety slow, inert, ordinary children, a very serious loss is inflicted, not only upon those ten, but upon the community in which the one hundred children are to grow up? There is a serious and probably an irreparable loss caused by the averaging of the ten with the ninety children. Therefore I say that uniformity in education all along the line is an evil which we should always be endeavoring to counteract, by picking out the brighter and better children, and helping them on by every means in our power."

CHAPTER XIII

THE NATURE OF MEMORY PROCESSES

MEMORY is one of the most important powers of the human mind, viewed either from the stand-point of the development of civilization or from the stand-point of the technique of education. Without it all education and all advancement would be impossible. It is only through the proper conservation of experiences, individual and collective, that progress is made possible. The more faithfully the experiences of the animal are recorded, the higher his place in the scale of development. There is no educational process into which memory does not enter as a factor of prime importance. Hence the significance of the study of the nature of memory and its training in a discussion of educational psychology.

Almost everybody assumes to know what memory is. Even the unlettered do not hesitate to advance a doctrine concerning its improvement. Volumes have been written, and many practical suggestions have been given, for the improvement of the memory, but it is only within very recent years that scientific doctrines concerning the nature of memory and its wise use have been evolved. Since all sound methods of its improvement must rest on the right conception of its nature, it is easy to understand that many of the older methods of training have been entirely overthrown. The old methods have been found to be not only incorrect, but some of them positively harmful. We shall see that all training of the memory must be carried on according to scientific principles. The old saws and sayings concerning memory-training are no more valid than the proverbs recording popular opinion of the weather, the treatment of disease, or many other popular dicta which really represent

superstitious credulity rather than scientific observation. We shall see that a sound theory of memory and its training will furnish many underlying principles of method in all education. Therefore, because of the vital connection between memory-training and all other intellectual, affective, and volitional training, it is of the highest importance that teachers have a thorough understanding of the subject.

A Preliminary Point of View.—In ordinary parlance, when memory is spoken of, the term implies the series of mental operations whereby facts are registered and retained in the mind, and at some future time reproduced. In this loose way of considering the matter, the various functions in the series are conceived of as being carried on independent of all physical or physiological relations, and the mind is supposed in some mysterious way to "store up" the impressions until needed, when they are again in an equally mysterious way "brought forth." The main difference between the older, popular conception and the newer scientific views is in the present recognition of the physical and physiological links in the series of phenomena. Memory, instead of being a "storehouse," consists of dynamic relations established through experience. There is now a quite definite "natural science" of memory. There is, to be sure, an unexplainable something beyond the sequence of observable phenomena. But that is not peculiar to psychology. The same is equally true of physics or chemistry. Natural science, in any realm, merely explains the series of changes that occur; the final what, why, and how are not attempted in the scientific discussion. Those questions belong to metaphysics rather than to science. The psychologist is as near to an explanation of the simultaneous or sequential occurrences of a brain state and a corresponding mental state as the physicist is to telling why negative electricity attracts positive, or why a body falls to the earth; or as the chemist is to explaining the cause of chemical affinity. They can each merely trace the serial changes. The psychologist, regarding his subject as a branch of natural science, should proceed in exactly the same way. To go beyond is to

invade the realm of the metaphysician and to forsake purely psychological methods.

Neural Modifications.—Whenever a stimulus acts upon a sense-organ it sets up some change, either mechanical or chemical, in that organ, which in turn causes a wave of impulse to be carried along the sensory nerve toward the brain. There a change takes place in the physical arrangement of the neural tissue. Just what this change is in every case, no one is able to say, but that there is rearrangement can be proved. In Laura Bridgman's brain, for example, the areas controlling functions which were exercised were normally developed, while the other portions were less well developed. We know that exercise of the brain causes a change in size. This is demonstrated through such experiments as those of Venn in measuring the heads of Cambridge students. Long generations of exercise of particular kinds have also produced the varying peculiarities of brain structure in different animals, *e. g.*, large areas for smell in the dog, large frontal areas in man, etc. Again, lack of exercise causes atrophy. This is demonstrated in the case of defectives like Laura Bridgman and others. These changes in neural tissue are made possible through the property of plasticity. There is also a tendency toward permanence of structure after changes have been wrought in the tissues. Growth means plasticity, and also tendency toward fixity.

Organic Memories.—Biologically, memory is not a property of neural tissue alone. There is ample evidence to support the belief that all living animal tissues possess memory. We may go a step further and assert that the basal factors of memory—registration, conservation, and reproduction of impressions gained through stimulation—are *common to all organic tissues.* All those modifications produced and conserved in living matter, plant or animal, are termed *organic memories.* Thus, muscular, osseous, cartilaginous, and vegetable tissues all possess organic memories of previous experiences. Organic memories include race memories as well as individual memories. The basis of heredity and instinct is organic memory. Huxley has written,

concerning the same point, the following: "It is not to be doubted that those motions which give rise to sensation leave on the brain changes of its substance which answer to what Haller called *vestigia rerum*, and to what the great thinker David Hartley termed 'vibratiuncules.' The sensation which has passed away leaves behind molecules of the brain competent to its reproduction—'sensigenous molecules,' so to speak, which constitute the physical foundation of memory." Meumann[1] has very recently emphasized and endorsed the biophysical idea of the fundamental meaning of memory first advanced by Hering.[2] The "dispositions," or "traces," produced by given experiences constitute the conserving element of all memory. The reawakening of these traces constitutes the biological basis of recall.

Biological Meaning of Registration.—We thus see that registration is primarily a physical phenomenon depending on the plasticity of the nervous structure. Retention is fundamentally physical and physiological. The neural substance, once changed in a given manner, tends by virtue of nutrition to maintain the new condition. It is not possible in every case to demonstrate that a change has taken place, and still more difficult to prove that the modifications have been conserved. But may we not draw upon the physical analogy of magnetization in which modification and conservation, though unseen, are certain and undoubted? The iron which has been magnetized has undergone a molecular modification. The eye cannot detect it, the balance record it, the scales measure, nor chemical reactions indicate; but the fact is attested by its behavior on certain occasions.

So, eye, ear, balance, or measure cannot prove that a few facts learned to-day modify my brain structure. But my behavior to-morrow, next week, next year, in old age, will tell the fact plainly. The particular facts I say I have forgotten, but why do I plan my business, arrange my affairs, entertain certain

[1] *Vorlesung zur Einführung in die Experimentelle Pädagogik*, Leipsic, 1907.
[2] *Memory as a General Function of Organized Matter*, 1870.

projects and immediately reject others? You say, because of the teachings of experience. Yes, but what is experience but the residuum of various individual effects which have been conserved, and in the light of which I give immediate judgment? The practical physician diagnoses a case and immediately prescribes before a novice could have detected symptoms. Why can he do this? He does not consciously go over all his previous cases, marshal each one individually before him; he does not recall his lectures, nor the books he has read. But in a no less true sense he remembers all his experiences, and now reacts differently for all those combined experiences. The next time he will act still differently in the light of the new plus all of the old. Dr. J. M. Buckley relates[1] "When but a boy I once sat in the office of Jay Cooke, when he was transacting the business that enabled the United States to proceed in the great conflict. A man came in and said, 'Will you take three hundred thousand dollars at such a rate?' Without a moment's hesitation Mr. Cooke said, 'No, sir.' Another man came in and asked, 'What will you give me on such a security?' 'The rate of one-sixteenth of one per cent. in advance of what I said last week,' was the immediate reply. I said to Mr. Cooke, 'You did not seem to think at all when you made those answers.' 'Of course I did not think. That is my business. All these things are in my mind all the time. You present them and I decide.'" Were the ideas *consciously* present, or even *present* at all?

Memory in Micro-Organisms.—It will be shown in the chapter on imitation that all living protoplasmic material possesses a certain power of selection among various stimuli, tending to avoid those that are harmful and to maintain those that are beneficial. Certain bacteria have been observed to avoid poisonous materials placed near them and to "fly from the mouth of the tube in haste, with all the external signs of intelligence and fear," but when an extract of beef is placed near them, "they swarm toward it from afar, crawling over one another." Similarly plants present a certain behavior toward certain stimuli,

[1] *The Chautauqua Assembly Herald*, August 10, 1901.

and once a reaction is set up there is a tendency to maintain it, even after the stimulus is removed. Furthermore, as cited by Baldwin, plants and unicellular animals "go after, or shrink from, a stimulating influence, according as its former impression has been beneficial or damaging." From these reactions Binet concludes that protozoa have memory, choice, and volition. Bunge says, "The behavior of these monads in their search after food, and their method of absorbing it, are so remarkable, that one can hardly avoid the conclusion that the acts are those of conscious beings." Baldwin does not care to commit himself, and so he says, "They behave as though they had" the various forms of intelligence ascribed.[1]

There appears to be no difficulty in accepting all the conclusions except the one concerning consciousness. Monads certainly possess memory, that is, power to record, conserve, and similarly react at subsequent times. They may exhibit choice, but it is blind choice, and they exert volitional activity, which fundamentally is the exertion of energy—self-activity—in the direction of remembered experiences, the first experience being accidental. Now, self-activity is a property of all animal and plant life. Animals exhibit self-activity in their appropriation of other forms to their own use, eating plants, consuming oxygen, mineral matter, etc., and assimilating these into their systems and converting them into their own bodies. Besides this, they move and feel, and in many cases possess quite high intellectual powers. Plants also grow according to hereditary patterns by reacting upon their environment in definite, predetermined ways. They must have light, water, carbon, salt, etc., and they sometimes struggle vigorously for existence. Witness the way that plants turn toward the light, strengthen themselves in weak places to withstand storms, tenaciously cling to and twine themselves around various objects, or vigorously push their roots through obstacles, even through stone walls or pieces of wood. The ideal forms which these beings attempt to assume are, of course, not conscious models, but nev-

[1] Baldwin, *Mental Development*, pp. 272–274.

ertheless as definite as many hereditary tendencies of man. "Nearly all of the process of self-activity," says Dr. Harris, "lies below the threshold of consciousness. In the case of assimilation (or digestion), mere vitality, all is unconscious." [1]

Subconscious Memories.—The great difficulty in the way of granting that psychic life is possessed by plants and micro-organisms (animal or plant) arises because psychic processes are usually considered identical with consciousness. Upon a moment's reflection this is clearly seen to be incorrect. A large part of the normal human psychic life is manifestly subconscious, and then to certain kinds of processes we cannot properly ascribe consciousness as a property at all. Consciousness is a cognitive, an intellectual state. It means an *awareness* of one's own mental processes. What then shall we say of all that volitional life of which we are not at all cognizant? Much of the affective life also never comes above the threshold of consciousness. It often requires close introspection to bring these states into full view. Regarded in this way the whole difficulty disappears. We can comprehend that all protoplasmic life possesses psychic power, but not necessarily consciousness.

The discussion presumably needs no further prolongation to convince that all living organic material possesses the function of memory; not necessarily conscious memory, but memory involving registration of impressions, conservation of the modified organism, and even the power of reacting similarly to once-experienced stimuli, and of repeating actions once initiated, even accidentally. Some may say that many of these processes are habits. Even so: that strengthens the case, for does not memory lie at the basis of all habits? Here, again, the unconsciously formed habits have not received their due share of consideration. Even human beings form numberless habits into which not a single *conscious memory* has entered. The subconscious, or even non-conscious, organic memories have

[1] *Psychologic Foundations of Education*, p. 31. For the best and fullest discussion of self-activity, see that work, chap. 3.

been the sole conservators of multitudes of experiences, perhaps accidentally initiated. The pedagogic value of understanding this thoroughly ought, also, to become more and more apparent. Its relation to the formation of habits of conduct is of inestimable importance.[1]

Physical Basis of Memory.—We have seen that the property of retention of impressions is possessed by all living tissues. In a certain sense we might say that even inorganic matter sometimes possesses memory. There are many analogues both of registration and retention in purely physical substances. If a piece of white paper on which a knife is placed is exposed to the actinic rays of the sun, it will, if kept in the dark, preserve the image of the knife for years. The photographer's sensitive plate records and retains impressions in a similar manner. The ocean which has its surface ruffled can never have identically the same molecular structure which it previously possessed. "Every impression," says Delbœuf, "leaves a certain ineffaceable trace; that is to say, molecules once disarranged and forced to vibrate in a different way cannot return exactly to their primitive state. If I brush the surface of water at rest with a feather, the liquid will not take again the form which it had before; it may present a smooth surface, but molecules will have changed places, and an eye of sufficient power would see traces of the passage of the feather. Organic molecules acquire a greater or less degree of aptitude for submitting to disarrangement. No doubt, if this same exterior force did not again act upon the same molecules, they would tend to return to their natural form; but it is far otherwise if the action is several times repeated. In this case they lose, little by little, the power of returning to their original form, and become more and more closely identified with that which is forced upon them, until this becomes natural in its turn, and they again obey the least cause that will set them in vibration."[2]

Dissolve a crystalline salt, say sodium chloride, and then let

[1] See Kuhlmann, *American Journal of Psychology*, 16: pp. 342–345.
[2] *Théorie générale de la sensibilité*, p. 60.

it recrystallize. The crystals will not resume the same positions relative to each other, but the crystals themselves will assume exactly the same geometrical form as previously. Water crystallizes in definite forms. Why is this? Who shall say that it is not at least a form of heredity? James quotes M. Leon Dumont, who says that inorganic substances and dead tissues form habits. "Everyone knows how a garment, after having been worn a certain time, clings to the shape of the body better than when it was new; there has been a change in the tissue, and this change is a new habit of cohesion. A lock works better after being used some time; at the outset more force was required to overcome certain roughnesses in the mechanism. The overcoming of their resistance is a phenomenon of habituation. It costs less trouble to fold a paper when it has been folded already. . . . The sounds of a violin improve by use in the hands of an able artist, because the fibres of the wood at last contract habits of vibration conformed to harmonic relations."[1]

Analogy of the Phonograph.—Lloyd Morgan compares analogically retention in the phonograph to physiological retention. "When we speak into a phonograph the tones of our voice are not hidden away in, and retained by, the cylinder of the instrument; but the wax or other material is indented, as a result of the incidence of the sound waves, in such a way that it is capable of reproducing similar sound waves at a subsequent time. So, too, the brain tissue is so modified by the nervous disturbances which are the accompaniments of an impression that, under appropriate neural conditions, they tend to reproduce similar nervous disturbances which are accompanied in consciousness by a reinstatement of the impressions in the form of an idea. It is in this sense only that we may speak of the retention of ideas. . . . The ideas as such have ceased to exist; but the brain structure has been modified in such a way that under appropriate conditions similar ideas will be again produced."[2]

[1] James, *Principles of Psychology*, vol. 1, p. 105.
[2] *Introduction to Comparative Psychology*, p. 106.

It should be added, however, that the foregoing is but an analogy, and most analogies are more useful for their suggestiveness than for the exact description of facts. The phonograph record lacks the real essentials of organic memories. There is no *organic tendency to persist* in a given condition after a record is made. Repetition of the same stimulus does not increase the impression made, or make it more lasting. The lapse of time leaves it unchanged if kept from the elements. In the case of the phonographic records, if a series of impressions (*b*) are superadded to the impressions (*a*), the impressions (*a*) are lost forever. There is no possibility of their reproduction in the sense that experiences are reproduced in memory. But in all organic memories there is a something within, we call it self-activity, that tends to arouse the same tracts and to increase the impressions. This is found true even in the bacteria exhibiting the "stimulus-maintaining or circular reaction." It is also true of human beings when the mind tends to think over what it has experienced. We have also noted that images may be awakened from within. This is impossible in the phonograph. Its substance is inert, lifeless. Organic tissue has what we call life—that which retains, revives experiences, and makes for progress. Evolution would be impossible without organic memory. A good illustration of organic memory without consciousness is seen in the phenomena of scars. Though the entire tissue is many times renewed, yet the scar persists. This is merely because of the law of growth. In all living organisms there is a continual renovation or replacement of tissue, and the new growth, particle by particle, takes the place of the worn-out tissues. Small-pox pits and the marks of other infectious diseases frequently remain through life. Bend a twig, and you cause nutrition to be supplied in the malformed direction until it has completely grown to the new mode.

Race Memories.—Every highly organized being that lives to-day is the resultant of the infinitude of complex modifications that have been exerted upon all the beings that have preceded it in its line of ascent. The changes have been more

than kaleidoscopic, producing innumerable combinations; they have been cumulative, so that it has been impossible ever to return exactly to the original state. Each stimulus leaves an addition besides a new combination. In multitudes of cases the combined resultants have so arranged the constituents that new forces have been able to cause the organism to vibrate in a new direction. Witness the development of the eye and the optical centres in the ascending scale of animal evolution. The cumulative memories of sensori-motor adjustments in this case produced a new potentiality or power. On the other hand, evolution may be regressive. Organic dispositions or vestiges may become so overgrown through disuse, or through the accentuated use of some other function, that the possibility of functioning in the given direction may become entirely obsolescent. Notice the decadence of the power of sight in the mole and many cave animals. Vestigial organs, as the vermiform appendix, the gill slits in the neck, or atavistic recrudescences, also attest the life in far-off ages still struggling to reproduce itself through organic memories.

Not only structure but function gives evidence of the cumulative race memories. The chick possesses at birth wonderful powers of perceptive co-ordination such as we know could not be attained in its lifetime. Neither were they learned during the period of incubation. They were accumulated during the lifetime of countless generations of which a given chick is a descendant. These ready-made powers we call instinct. But, in other words, they are inherited neural memories awaiting excitation by racially familiar stimuli. The question will, therefore, naturally arise here as to why man with his wonderfully expanded memory does not exhibit more racial memories. This subject is more fully treated in the chapter on Instinct, and it will merely be remarked here that it is because of the exceeding complexity of man's memories that they are not evidenced instinctively. Furthermore, most of our important memories are never awakened in exactly the same character in which they were registered. They are awakened only as totalities, and not

as individual experiences. In individual life, to illustrate, man strives to remember not isolated details, but rather generalizations—conceptual notions. We remember the content of concepts, without being under the necessity of clothing them in any particular *form.* Unfortunately the untrained person thinks of the *form* when memory is mentioned. But the form in which an idea is clothed is by no means the most important part of the memory. The trained psychologist, for example, can tell instantly, *i. e.*, he can remember, the definition of "perception," but the chances are that he will not word it twice alike. Likewise man has instincts or inherited dispositions for subjects or fields of activity rather than for the particular form of the subject or field of activity. Thus, man truly inherits a capacity for mathematics, but it may be put in arithmetical or geometrical terms, in English or Chinese characters. Similarly a capacity for music is inherited. If this is doubted by any one, let him try to teach a dog, a pig, or a monkey to compute, to sing, to talk, and see if he will not wish for hereditary tendencies to begin with. The entire discussion of instinct and heredity was a contribution to the subject of *race* memories, and consequently a brief paragraph in this connection is sufficient.

Physiological Conception of Reproduction.—Physiologically the simplest case of reproduction of previous states is brought about when the nervous system is awakened by the same stimulus which gave rise to the original mental state—sensation, perception, etc. That is, recall or remembering, physiologically considered, is simply the reinstatement of processes which have been experienced at some antecedent time. Thus, if a stimulus a has impinged upon an end organ with a certain rapidity of light or sound vibrations, or with certain mechanical or chemical reactions, in such a way as to produce a given mental state A, theoretically, in its last analysis, to recall A at some future time the stimulus a must be repeated, when it will give rise to a mental state A^1. This second state would be so similar to A as to be interpreted as identical with it. In truth it cannot be exactly the same, for the nervous system receiving and recording

the impression is not the same as it was when it received the impression interpreted as A. Again, let us say that the nervous system which received the stimulus a had been in its history disturbed by a number of shocks producing a resultant which we will designate as N. Therefore, if b impinges upon the end organ, it will be the nervous system $N+$the effect from a instead of N which reacts to the stimulus b. This conclusion must follow our acceptance of the physiological interpretation of the doctrine of apperception, or the doctrine of the conservation of energy.

On the general physiological aspect of retention and reproduction Kay writes: "It seems highly probable, then, that the recalled sensation or idea is occasioned by a repetition of the same form of motion as attended the original sensation. The sensation of red is produced by a certain kind of motion, and the idea (memory) of red is in all probability produced by the same kind of motion. This doctrine is as old as Aristotle, who viewed the representations of memory or imagination 'as merely the movements continued in the organ of internal sense after the moving object itself has been withdrawn.'"[1] Spencer says: "To recall a motion just made with the arm is to have a feeble repetition of those internal states which accompanied the motion—is to have an incipient excitement of those nerves which were strongly excited during the motion."[2] Ribot also maintains that the nervous processes in perception and remembrance are the same. He cites the well-known experiment of Wundt, who found that the mere remembrance of a color produced the same fatigue and also, what is more striking and conclusive, that the same complementary color appeared as when fatigued from viewing the original. Baldwin, in his discussion of the physical basis of memory and association, says that memory on the bodily side is "the reinstatement in the nervous centres of the processes concerned in the original perception, sensation, etc. . . . So the function of the reinstatement of processes in the act of memory

[1] *Memory: What It Is and How to Improve It*, p. 31.
[2] Quoted by Kay, *op. cit.*, p. 31.

is, in respect to the tendency to action which these processes arouse, exactly the same as that of the processes of perception, sensation, event, which furnished the original of the memory."[1]

Myriads of ideas received will never have all the conditions for their recall repeated. Either similar stimuli will not occur, or they will not be suggestive because of their weakness or because of long lapse of time. This explanation suffices, however, for the reproduction of only the most simple and elemental states. Were this the sole condition of reproduction, we should be limited to those ideas in which the original stimulus reappeared. Our mental lives would be exceedingly circumscribed and simple, even though a certain number of "circular" or "stimulus-maintaining reactions" occurred as are explained in the chapter on imitation. Psychical life would scarcely rise to the dignity of perceptive consciousness, for all our perceptions are complexes formed out of multiple associations. These associations are at the basis of our complex memories, and explain how a given object of consciousness may be recalled without the necessity of the presence of the original stimulus. In perception a given object of thought becomes associated with diverse other objects as *a*, *b*, *c*, *d*, *e*, *f*, etc., which are similar, contiguous, contemporary, a part of, etc., and the presence of a stimulus which causes the reinstatement of any one of the elements of the series at once awakens nerve-tracts which have previously been discharged along with the given one, and there is a tendency for all the others to be discharged. Which one is exploded will depend upon the frequency, recency, contiguity, etc., of previous associations. This will all be explained in the discussion of association, and needs here to be merely suggested.

Persistence of Memories.—"How long do memories persist?" is a pertinent question, and one frequently raised. In the foregoing discussion it has virtually been assumed, though rather disguised, that impressions once made persist throughout the normal life of the individual. We shall here attempt to show that

[1] *Mental Development*, p. 280.

this is true, and even go beyond that to assert that they are as eternal as the life of the individual. If life is propagated, the memories tend to persist in the progeny. This need not startle, for it is only a corollary of the doctrine of heredity. Ordinarily the theory of heredity considers only the persistence of race *habits*, but it must be understood that memories are transmitted even though they have not attained to the definiteness, and to the reflex stage, of habits.

I fancy the reader will here interpose a question, as several hundreds of my students have done. They say, "How can it be that memories are permanent? Our experiences tell us that we forget myriads of things. One who never forgot would be more than a prodigy: he would be superhuman." Just a moment. I have not asserted that things are not forgotten. My own discomfiture on forgetting the spool of thread or the marketing, or to mail my letters; my embarrassment on awkwardly trying to recall the name of a student whom I have previously met; my careful avoidance of calling certain people by name, because I can not think of the right one: all these and scores of other cases would readily rise up to contradict such a statement, if ever I should make one. But I have not said that we never forget. I have said that memories are permanent, in the sense that the records are ineffaceable. It, however, has not been asserted that all experiences can be *recalled*. It is not contended that all memories are *complete*. The point intended to be made here is that *every* experience, no matter how great or how small, how significant or unimportant, enters into the complex of one's life and tends to bias his conduct ever afterward. Every thought, every emotion, every impulse, no matter how noble or ignoble, how uplifting or debasing, how idle or important, leaves its ineffaceable trace. The student goes from the class-room a different individual from what he entered; his contact with his teacher has influenced him for good or for ill, imperceptible though it may be. These are solemn thoughts, disturbing to the one whose experiences have been unfortunate; reassuring to the one with more happy experiences.

Biological Conception of Recall and of Forgetting.—It has already been shown that whenever a stimulus re-traverses the same path which it has before traversed, the process of reproduction takes place. If the previous impression was strong enough, vivid enough, and if sufficiently recent, it is recognized as a former experience. In this case there is complete memory. But the conditions for reawakening the same nerve-tract are that the same or a very similar stimulus must impinge upon the end organ, or that a stimulus must occur which will arouse tracts or centres which have been associated with the given centre. As James says, "*The cause both of retention and of recollection* [*reproduction*] *is the law of habit in the nervous system, working as it does in the association of ideas.*" And again, "The machinery of recall [reproduction] is thus the same as the machinery of association, and the machinery of association, as we know, is nothing but the elementary law of habit in the nerve-centres." In another place, in speaking of the processes going on he says: "*When slumbering, these paths are the condition of retention; when active, they are the condition of recall.*"[1] By a path all we mean is, that a certain arrangement of molecular structure has taken place so that nerve currents are conducted from one centre to another with greater facility than before the rearrangement. We know, for example, that currents travel better lengthwise of the nerve fibres than crosswise. Through ages these have become good paths of conduction. The association fibres of the brain and the phenomena of association teach us that homogeneous tissues have to become differentiated before they become very efficient.

A great variety of changes is produced by the numberless incoming stimuli which are continually impinging upon the end organs. After a given stimulus a has affected the neural substance and opened a tract $a \longrightarrow x$, usually before the same stimulus is repeated and deepens the impression, many stimuli of a different character have modified the nervous structure in such a way as partially to rearrange the tract $a \longrightarrow x$. It may

[1] *Principles of Psychology*, vol. I, pp. 653–655.

be that the molecular structure is rearranged so that a new tract $b \longrightarrow y$ crosses through the tract $a \longrightarrow x$. Suppose these, in turn, to be influenced by many other stimuli. A "modified modification," which may be represented in a purely diagrammatic way by the accompanying figure, finally results from the action of all the combined stimuli. Because of these modifications by new impressions from without and from the neural changes brought about by associations from within, many impressions, sooner or later, will become so obliterated that they can never be recalled. However, if we believe in the conservation of energy and in apperception, we must conclude that every

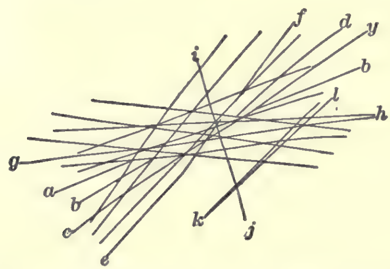

FIG. 29.—Diagrammatic representation of neural effects produced by manifold stimuli.

impression has modified the nervous system in such a way that every new impulse must take a different path because of it. The pail of water is molecularly different after the addition of each drop, even though no molar change is perceptible. In fact, does not the law of gravitation teach us that every change in every particle of matter in the universe affects every other particle? Under certain conditions, explained under "degeneration and revival," memories apparently completely obliterated may be reinstated.

There are many facts of psychic life that help to prove the theory of the permanent retention of these once-made nerve-tracts, which we may assert have permanent possibilities of recall. To illustrate, how many of us have revived memories of scenes and events long since forgotten, judged by ordinary tests,

by going back to the places where the impressions were gained? Going back to childhood's home after long years of absence brings a flood of recollections that never would have been revived had it not been for the proper stimuli. Those things were learned in connection with certain associations, and the old stimuli, or their associates, are absolutely necessary for their recall. If the impressions have been vague or fleeting, even the presence of the stimuli would not serve to revive the memories. An important pedagogical truth may be drawn from these facts. Children learn their lessons in a particular order, or in a particular way. The teacher often asks questions on the lesson which, though pertinent and intelligible to older people, have no meaning to the children and do not serve as "suggesting strings," to use Carpenter's phrase, in reproducing the lesson. The teacher must take care to question and to extend explanations in the same lines of association as are in the children's minds. Otherwise discouragement will come frequently, because the results seem so poor. For small children at least, and probably all through the college course, the one who teaches the class, not an outsider, should be the examiner. The superintendent is liable to ask questions in an entirely different way and no "suggesting strings" are pulled. Even in college oftentimes I ask a question which is an application of something the students have learned. I get no response, and gradually change the question. All at once some student exclaims, "Why, yes; I knew that all the time!" No "suggesting string" was at first pulled. Great care is necessary in setting examination questions, even in high school and college. The questions should be so framed that they will be sure to suggest the line of answers desired. When a question is carelessly constructed the student frequently guesses at its meaning, and often writes on another question. The more advanced the student, the more general, of course, may be the question.

Revival after Long Lapses.—Carpenter[1] says that "There is very strong physiological reason to believe that this 'storing-up

[1] *Mental Physiology*, pp. 436 *et seq.*

of ideas' in the memory is the psychological expression of physical changes in the cerebrum, by which ideational states are permanently registered or recorded; so that any 'trace' left by them, although remaining so long outside the 'sphere of consciousness' as to have *seemed* non-existent, may be revived again in full vividness under certain special conditions—just as the invisible impression left upon the sensitive paper of the photographer is developed into a picture by the application of particular chemical re-agents. For in no other way does it seem possible to account for the fact of very frequent occurrence, that the presence of a fever-poison in the blood—perverting the normal activity of the cerebrum, so as to produce *delirium*—brings within the 'sphere of consciousness' the 'traces' of mental experiences long since past, of which, in the ordinary condition, there was no remembrance whatever. Thus, the revival, in the delirium of fever, of the remembrances of a language once familiarly known, but long forgotten, has been often noticed." Dr. Carpenter supports his theory by citing a number of cases gleaned from prominent medical authorities, some of which are here subjoined. "An old Welsh man-servant, who had left Wales at a very early age, and had lived with one branch or another of this gentleman's family for fifty years, had so entirely forgotten his native language, that when any of his Welsh relatives came to see him, and spoke in the tongue most familiar to *them*, he was quite unable to understand it; but having an attack of fever when he was past seventy, he talked Welsh fluently in his delirium. . . . A Lutheran clergyman of Philadelphia informed Dr. Rush that Germans and Swedes, of whom he had a considerable number in his congregation, when near death always prayed in their native languages; though some of them, he was confident, had not spoken these languages for fifty or sixty years."

"The following case, mentioned by Coleridge, is one of the most remarkable on record: its distinguishing feature being that the patient could never have known anything of the meaning of the sentences she uttered: . . . 'In a Roman Catholic town in

Germany, a young woman, who could neither read nor write, was seized with a fever, and was said by the priests to be possessed of a devil, because she was heard talking Latin, Greek, and Hebrew. Whole sheets of her ravings were written out, and found to consist of sentences intelligible in themselves, but having slight connection with each other. Of her Hebrew sayings, only a few could be traced to the Bible, and most seemed to be in the Rabbinical dialect. All trick was out of the question; the woman was a simple creature; there was no doubt as to the fever. It was long before any explanation, save that of demoniacal possession, could be obtained. At last the mystery was unveiled by a physician, who determined to trace back the girl's history, and who, after much trouble, discovered that at the age of nine she had been charitably taken by an old Protestant pastor, a great Hebrew scholar, in whose house she lived till his death. On further inquiry it appeared to have been the old man's custom for years to walk up and down a passage of his house into which the kitchen opened, and to read to himself with a loud voice out of his books. The books were ransacked, and among them were found several of the Greek and Latin Fathers, together with a collection of Rabbinical writings. In these works so many of the passages taken down at the young woman's bedside were identified, that there could be no reasonable doubt as to their source.'" [1]

The words of Dr. Carpenter confirm this view. He says:[2] "As our ideas are thus linked in 'trains' or 'series,' which further inosculate with each other like the branch lines of a railway or the ramifications of an artery, so, it is considered, an idea which has been 'hidden in the obscure recesses of the mind' for years—perhaps for a lifetime—and which seems to have completely faded out of the *conscious* memory (having never either recurred spontaneously, or been found capable of recall by volitional recollection), may be reproduced, as by the touching of a spring, through a *nexus* of suggestions, which we

[1] *Biographia Literaria*, edit. 1847, vol. I, p. 117.
[2] *Mental Physiology*, p. 429.

can sometimes trace out continuously, but of which it does not seem necessary that all the intermediate steps should fall within our cognizance." Carpenter quotes a paragraph from Dr. Abercrombie's records to substantiate his position. "A lady, in the last stage of chronic disease, was carried from London to a lodging in the country:—there her infant daughter was taken to visit her, and, after a short interview, carried back to town. The lady died a few days after, and the daughter grew up without any recollection of her mother, till she was of mature age. At this time she happened to be taken into the room in which her mother died, without knowing it to have been so:—she started on entering it, and, when a friend who was with her asked the cause of her agitation, replied, 'I have a distinct impression of having been in this room before, and that a lady who lay in that corner and seemed very ill, leaned over me and wept.'"[1]

An extended purposive study of early memories, made by Dr. G. Stanley Hall,[2] gives many definite examples illustrating the theory just advanced. He writes: "I undertook, as a vacation diversion, a more or less systematic exploration of all the farms I had ever known, noting on the spot everything remembered from early boyhood. I climbed in through the windows of abandoned houses and explored them from roof to cellar in quest of vestiges; sat alone sometimes for hours trying to recall vanished spots, and to identify objects which I knew must have once been familiar. Thus during the month I noted between four and five thousand points, sometimes revisiting the same scene to observe the effects of recurrence, and from it all I gathered some general impressions of memory, quite new to me." On the first farm visited he had lived during the first two and one-half years of life. Although he had driven past it several times, he had not been upon the place for nearly fifty years. He states that thousands of memories were revived by the recurrence of once-experienced stimuli and their associates. Space will permit recounting but a few of them.

[1] *Intellectual Powers*, 5th ed., p. 120.
[2] "Note on Early Memories," *Pedogogical Seminary*, 6: pp. 485–512.

Out of all of the very many objects and incidents that were impressed upon his mind as a child, almost nothing was definitely recalled. The only clear and distinct memory was of a red, upright, wooden spout with a wheel attached, through which he had poured water. Of this object he had often thought. Another memory, certain though indistinct, was revived by "the rocky end of a knoll" with which there "came an almost imperative association of cows being milked by a woman." He found that the hired man's wife had milked the cows there. But there were many associations that bore marks of familiarity, of which he writes: "I have little doubt but that if I had met that ensemble of landscape features unexpectedly in some far country I should have been struck by some reverberations of reminiscence perhaps akin to those Plato connected with a previous state of existence." Not only were old places recognized, but many incidents once associated, but now no longer present, were recalled. Who has not had a strange feeling of familiarity in some locality or with some occurrence to which he believes himself a stranger? It may have proved to be a real memory or it may have been merely a similar experience serving to recall old experiences. "A kind of open glen in the woods, for instance, recalled nothing, but gave a very extraordinary and unwonted sense of pleasure and of previousness. On coming to a knoll upon a vast heap of stones near trees I found myself articulating, 'Why yes, of course there was something like that.' . . . The sudden smell of catnip, the gloominess of an old wall of very black stones, a deep well beneath the kitchen, the abundant and peculiar moss on the ledges, were other things that brought a distinct sense of familiarity but no trace of anything like memory."

Degeneration and Revival.—The revival of memories depends upon stimuli suitable and sufficient to make old paths function. Many memories may never be reinstated for the lack of such stimuli. The reinstatement of memories in old age and in sickness will not be so readily understood, and may need argument to convince. That such occurrences arise, many facts attest.

Examples of such have been quoted above. Why these occur remains to be explained. It is a well-established neurological law that in degeneration of tissues during disease or old age the first tissues to disintegrate are those most recently formed; while the older, first-formed are the last to be attacked. This is easily explained by reference to purely physical and chemical laws. A substance that is simple is relatively stable, while those which are more complex are correspondingly unstable, and the more complex the substance the more liable to disintegration. Thus we see that the nervous tissue, being exceedingly complex, is the most unstable compound in existence. It is, in fact, so complex that no chemist feels safe in asserting the definite composition and atomic relationships. Here we see why nervous tissue is peculiarly fitted structurally for the functions which it subserves. Compare it in composition and function with fat or muscle. Were the nervous tissue not so thoroughly protected it would be the first tissue to go into dissolution. Of the nervous system itself medical authorities tell us that the first part to be attacked in disease is the cerebrum, the medulla and pons following next, while the cord is the last to be attacked. This law is known as that of *descending degeneration.*

We have already mentioned that in disease many of the most recent impressions are entirely forgotten, while others that are remote and early formed are perfectly fresh and remarkably vivid. It is also well known that in old age the early memories are the ones that persist. Old age is a form of disease. It implies descending degeneration in a large sense. Life disintegrates until only the so-called second childhood is left. Putting together the law of descending degeneration and the perfectly obvious facts of the return of old memories and the loss of recent ones, we know that the given order of psychical decay ensues because the neural structures formed by the most recent psychoses are the first to decay. As previously mentioned, the newer structures act as inhibitors or insulators of nervous material, preventing the flow of nervous energy in certain directions.

These later structures become diseased, the inhibiting force is removed, allowing the older structures opportunity to function again. This they do if suitable stimuli are presented. These stimuli may come from within or from without. The old man may not think continually of the scenes of his boyhood, but just give him the cue and see how the ideas will cause the awakening of slumbering brain-tracts and in turn how the old neuroses reinstate old psychoses. Habits are the last functions to be forgotten. There are two reasons for this: (*a*) The processes have been so long and frequently continued that the neural structure has grown to that mode. (*b*) The spinal cord is the oldest formation of the nervous system in racial development—fundamental—and hence the last to succumb. When all other functions are deranged and unbalanced in the nervous wreck or in the demented, the early habits still persist intact. In the decline of memory during old age or in nervous debility, proper names are the first to be lost. They are special—accessory—used only occasionally, and largely recently learned, and hence their application is seldom automatic. Other words are so habitually used that the chain of sounds becomes automatically reinstated.

Individual Differences.—There are very great differences of memory among individuals. There are persons who acquire readily, but forget quickly; those that acquire with difficulty, but retain accurately and tenaciously. Again, there are fortunate persons who acquire easily and retain with great persistence and fidelity, as well as some who work hard to acquire only to be chagrined on having what is learned evaporate almost as soon as learned. When one remembers things learned through a given sense better than what is learned through the other senses, we say he has a certain "type" of memory. There are types of memory corresponding to all of the senses. Some persons possess one type, some another. Again, there are persons who have memories that vary within the realm of a given sense. There are also all degrees of variations, from the special power of remembering remarkably, certain words, certain forms, certain sounds,

or certain colors, up to the very exaggerated cases which we find in abnormal persons, or the mathematical, musical, and other "prodigies."

There are also differences in the same individual at different stages of development. Children are usually thought to have better memories than adults. This view is hardly correct, however. Children's memories are different from adults'. Children acquire, even mechanical associations, more slowly than adults. They retain mechanical associations better when once learned, but adults retain thoughtful associations better. Both the power of registering and retaining thoughtfully increase up to about twenty-five years. The powers are relatively stationary then until about fifty, when a gradual decline sets in.[1] These various differences suggest a recognition of different methods of teaching children of different ages, and also an adaptation of means and methods for persons of different memory types. Further discussion of the subject will be found in connection with the treatment of individual differences, memory training, and of imagination.

What Experiences Are Remembered.—Of how great intensity must sensations or perceptions be in order to be remembered is a question that naturally rises. No stimulus produces much of a sensation until of sufficient intensity to rise above the threshold, *i. e.*, to enter into consciousness. The threshold differs for different senses and in different persons. Vibrations of a sounding body must be as rapid as eight or ten per second, and for most persons as high as twenty-four per second, in order to produce a sensation. Beyond fifty thousand a second they can no longer be detected. However, it is quite probable that many stimuli which do not produce recognizable sensations have some effect upon the nervous organism and upon the mind. And just as every physical influence in the course of evolution has modified things within its scope, so we believe that all stimuli of sufficient intensity to modify nervous matter or

[1] See Meumann, *Vorlesungen zur Einführung in die Experimentelle Pädagogik*, pp. 189–203.

mind in the least have left memories of their action. It is not to be supposed that all impressions of slight intensity, even though they attain the dignity of sensations, perceptions, or even more complex states, are necessarily recalled. They may be recalled in peculiar or abnormal conditions, or in hypnotic states, but even if too slight for recall under such circumstances, they color all our subsequent life and have their influence upon the general course of conscious memories. There are, in fact, exceedingly few things that are recalled exactly, or even need to be. But we may be certain that every influence to which we are subject leaves its "trace" upon our lives, and, of still more far-reaching importance, upon all posterity. As James remarks, "We are spinning our own fates, good or evil, and never to be undone. Every smallest stroke of virtue or of vice leaves its never so little scar. The drunken Rip Van Winkle, in Jefferson's play, excuses himself for every fresh dereliction by saying, 'I won't count this time!' Well! he may not count it and a kind Heaven may not count it; but it is being counted none the less. Down among his nerve-cells and fibres the molecules are counting it, registering and storing it up to be used against him when the next temptation comes. Nothing we ever do is, in strict scientific literalness, wiped out. Of course, this has its good side as well as its bad one. As we become permanent drunkards by so many separate drinks, so we become saints in the moral, and authorities and experts in the practical and scientific spheres, by so many separate acts and hours of work." [1] Colgrove[2] writes on this point: "Perhaps that was not wholly a dream of De Quincey, Swedenborg, and Coleridge that the angels would come in the judgment day and take a complete record of our lives from the traces left in our bodies and nervous systems, and that by these we should be judged. If these are the books which are to be opened, a record trustworthy enough to determine destiny will be found. Each record in itself makes destiny." Prof. Ewald Hering asserts in that pioneer work on the

[1] *Principles of Psychology*, vol. I, p. 127.
[2] *Memory*, pp. 167–169.

newer theory of organic memory[1] that, "The conscious memory of man dies with his death; but the unconscious memory of nature is faithful and indestructible. Whoever has succeeded in impressing the vestiges of his work upon it, will be remembered forever."

[1] *Memory as a General Function of Organized Matter*, p. 27.

CHAPTER XIV

THE NATURE AND EDUCATIONAL SIGNIFICANCE OF ASSOCIATION

Illustrations of Mental Associations.—I walk by a certain building and suddenly find myself thinking about a friend whom I have not seen for years. Why should these thoughts dart into my mind so unceremoniously and unbidden? Even as I wrote the above sentence I suddenly found my mind wandering far away to a certain scene near my boyhood home which I have not seen for many years. Why should writing educational books be mixed up with my thoughts of boyhood episodes? Again, I recline in my easy-chair before the hearth and gaze into the fire with no particular thoughts in mind, and with only a comfortable unconcern. I indulge in day-dreams, and suddenly, when aroused to full consciousness, I find that I have wandered to far distant places and to scenes and events long past. Why should the remote be so connected with the present? When I listen to a speaker, or when I read a book, I try to have my thoughts follow the line suggested by the speaker or the writer. When I follow out a particular line of thought of my own I also take a somewhat definite course marked out by the nature of the thinking or by my own former course of thinking, but when I allow my thoughts to wander I find them taking strange and devious paths.

In all these and similar cases, the particular ideas are called into consciousness because of some chain of relations which we have previously forged in our minds, and because of some factor in our present experience which is also common to the chain of relations previously established. To illustrate, on coming to the university, I now recall that the last time I saw my friend we were standing in the doorway of a particular

building. The sight of the building was a stimulus which aroused a series of mental processes one of which was the idea of my friend. I had good cause to think of my friend in relation to that building as we parted. Those two experiences, the idea of the building and of my friend, had been registered together in my consciousness at the time. The recurrence of any stimulus once experienced tends to revive memories of all events connected with it. The reason will appear plainer after considering the physiological basis of association. Again, as I wrote the word "friend" my mind at once and naturally reverted toward some of my friends, and, for some reason, the particular one thought of was a relative; probably because in forming friendships one most usually comes in contact with relatives first, and also much more frequently. Again, as most of my relatives now reside near my boyhood home, my thoughts at once turned in that direction. But while contemplating that closely related set of experiences, I notice that my mind flits from scene to scene, event to event, until I am far away from the original series. However, as I analyze the steps carefully I find that no new idea has arisen in consciousness which has not been *previously related in my mind* to that which suggested it. This, we may be sure, is true even though we may not be able to trace the various connections. This statement is warranted by experimental evidence, and by the physiological basis of recall in memory.

If one hears a word, no ideas ever flash into mind that have never been associated with the word. The following experiment never fails to prove interesting and instructive to classes. Pronounce the following or other words and ask the class to write down, after each word is pronounced, the first word that comes to mind: George, president, superintendent, Manila, one, watch, Ivory Soap, Milwaukee. It is possible to predict what most of the words written will be. I have repeated the experiment many times, and have seldom been unable to trace the direct connection between the suggesting word and the recalled idea. Inasmuch as so many ideas are continually

coursing through our subconsciousness, it is not difficult to understand why curious and apparently unrelated ideas frequently arise.

Illustrations of Physiological Associations.—The chains of associations thus far considered are all drawn from the realm of mental experiences; but associations are not limited to psychical processes. Mechanical muscular activities are learned by all animals. When the processes become deep-seated they are termed habits. In physical processes such as swallowing, winking, and walking, there is a definite relation between stimulus and reaction. Food entering the œsophagus is the stimulus for the contraction of certain muscles; the contraction of these muscles is the signal or stimulus to still other contractions or relaxations. Stimulus becomes associated with reaction; reaction with other reactions, and so on. Thus various elements become associated in the mere physical and neurological processes. In many physiological processes there is no mental element, *e. g.*, in digestion, propulsion of the food in the alimentary canal, and in the circulation of the blood. The physiology of habit is explainable on exactly the same basis as the above mechanical muscular activities. Through activity there is produced a discharge of nervous energy in a particular direction. This is repeated so often that the slightest stimulus of a certain sort effects a discharge of nervous energy in the given direction. Here we have an association between stimulus and nervous activity, between these and muscular activity, and also between each stage of muscular activity and the succeeding one. Even in plant life there is the same sort of association between stimulus and reactions, and between each stage in physical reaction and the next. These organic associations thus lie at the basis of memories. This fundamental meaning of association is thus emphasized because it will be discerned that it is of the highest pedagogical value in considering economical learning and memory.

All our every-day habits depend upon motor reactions of a mechanical sort. Standing, walking, arranging one's clothes,

opening and closing doors, avoiding obstacles, following habitual paths, holding one's book open to read, dipping one's pen in the right bottle, using knives and forks properly, etc., could not be carried on were these organic associations not properly established. Skill in games is reached only after effort in establishing muscular co-ordinations (associations). Once established, it is necessary only to think of the end in view to awaken the entire sequence of processes necessary to accomplish the result. Each step is the necessary stimulus to call the next step into activity. The associations formed in riding a bicycle or learning to dance are very largely physiological. Little mentality needs to be put into either act. What there is belongs to the ideo-motor type. An obstruction is encountered with the bicycle. The muscles hit upon the successful method of acquiring control, and this co-ordination is remembered, not as a conscious process, because few could describe it, but it is retained as organic memory.

Such school activities as writing, drawing, oral reading, and spelling, acquire perfection only after mechanical, organic associations have been definitely fixed. The learning of one's mother tongue depends upon associations (*a*) between the idea and the word, (*b*) between the sound of the word and the movement of the vocal organs in producing the sound, (*c*) between the idea and the written or printed symbol, (*d*) between the sound of the word and the written or printed symbol representing it, (*e*) between each of these and the various qualities making up the idea. Halleck has given an excellent discussion of the complexity of association in understanding a simple object. In the same discussion he also shows clearly the necessity for a physical basis of association.[1]

The Physical Basis of Association.—Association cannot be clearly understood until it is studied from the physical and the physiological sides. From what was said concerning the physical basis of memory it will be recalled that when a given stimulus acts upon any part of the nervous system it produces a physio-

[1] *Psychology and Psychic Culture*, p. 112.

logical change. This modification tends to be made permanent by the nutritive processes. Now, all perceptive processes are very complex and are the result of a fusion of numerous sensations. To take a concrete example, let us consider the processes involved in forming the perception of an orange—the classic psychological fruit. The visual sensation representing the color becomes associated with the visual sensation representing the shape, each or both of these with the taste, the odor, the touch, and the sound when the orange is dropped or tapped or scratched. Sometimes it is the sensation of color which is connected with that of taste, sometimes that of taste with color; again the odor is perceived, and that associated with its sight or its taste. These and manifold other experiences are fused in developing the complete idea of the orange. Thus through experience each sensation has stimulated a flow of nervous energy from the seat of one class of sensations to that of another. This tends to fix the path in that direction and between these two centres. But in the process of becoming acquainted with (perceiving) any given object, these associations are made in many directions—and, if accurate, the more diverse the better the perception. Besides these we have the muscular sensation in saying the word orange, the auditory sensation in hearing it, the temperature sensation from touching it, the muscular sensation from lifting it, and possibly we may have written the word and thus have received added visual and muscular sensations. Subsequently when any particular stimulus is received from the orange, *e. g.*, that of color, all the other centres involved are communicated with and the entire complex flashes into mind. The orange is not much of an orange until we have associated every sensation derived from it with every other one and have all combined. Helen Keller's percept of an orange lacks certain very important qualities. Her knowledge of the sky, and of many flowers, and of painting, is sadly incomplete. The association fibres of the brain are no myths. Because of their number and complexity in man he is able to form ideas that are exceedingly complex compared with those of the lower animals.

We think of perceptions as being simple mental phenomena, but in reality they are very complex. I see before me an orange. What separate ideas have I of the qualities of the orange which enable me to recognize it? In the first place I see only a patch of yellow color. What other qualities can I assert of the orange? I know that it has a rough, grater-like skin, although I do not touch it. I can tell that the inside is made up of a pulpy mass, probably containing seeds, and full of juice, which will spurt out if pressed. I know the smell and the taste, also, so that I can revive them, or, at any rate, could tell whether you gave me an orange or an onion or a red-pepper. I can also image the weight of the orange. All these ideas always occurring together in my mind have become *associated* to make up my idea of orange. You speak the word orange, and what comes into my mind? Why, some quality of the orange. Perhaps its color. It may be its odor, its shape, its feel, its weight. I get the odor, and the color, taste, and the other qualities come to mind. I see it and its name, and some of the other qualities are recalled. Why is this? It is because all these ideas have become welded together so that when one is disturbed or stimulated all the rest in the complex tend to be awakened into activity. Titchener expresses this from the psychical point of view as follows: "*All the connections set up between sensations*, by their welding together into perceptions and ideas, *tend to persist.* A sensation which has once formed connections with other sensations cannot shake them off and be its own bare self again,—the bare sensation that it was when it entered for the first time into a perception,—but carries its connections with it; so that whenever it has a place in consciousness, the connected sensations tend to be dragged in also. This law is the law of the *association of ideas.*" [1]

Definitions of Association.—We are now ready to give a somewhat more formal definition of association. *Whenever two or more experiences are registered together, the recurrence of one of them tends to revive the others with which it has been registered.*

Halleck has defined the process as follows: "Ideas or objects

[1] *A Primer of Psychology*, p. 130.

that have been before consciousness at the same time, and hence apperceived in the same mental state, tend afterward to suggest each other."[1] This definition is an excellent statement concerning conscious mental states, but it will be seen at once that it does not include subconscious mental states, and, still less, muscular and other organic associations. James has stated the case well in terms of cerebral physiology. He says:[2] "*When two elementary brain processes have been active together or in immediate succession, one of them, on recurring, tends to propagate its excitement into the other.*" This would express the exact conditions if the words "neural" or "organic" were substituted for "brain." That is what James implies, and definitely says in the expression: "There is no other *elementary* causal law of association than the law of neural habit."[3] And again when he says, "This ultimate physiological law of habit among the neural elements is what *runs* the train."[4]

Association and Suggestion.—What has been discussed by many writers as association is not really association at all, but *suggestion.* The discussions are somewhat as follows: "Association is that process in reproduction by which past ideas are brought back through connection with something present in the mind." "Association of ideas is the means by which a successive train of ideas arises." "Thinking about anything tends to make one think of something connected with it. This mental fact is called the association of ideas."

Association is, however, instead of a process of recall, the process of *registering* the experiences together, of *establishing relations* among them. It is an explanation of the cause of recall. Because of the associations which were made at the time of registration, some object now in consciousness may serve as a stimulus to recall some idea or train of ideas. The fact serving as a recall-stimulus is a *suggestion.* But the nature of the recall and the order of the recall were determined by previous associa-

[1] *Psychology and Psychic Culture*, p. 114.
[2] *Principles of Psychology*, vol. I, p. 566.
[3] *Loc. cit.*
[4] *Op. cit.*, p. 581.

tions. Association is a *registration* process rather than a recall process.

The Direction of the Association.—Associations are the basis of habits, and as in habits, the activities in a chain of associations become linked together in such a way that the order becomes very definite. Everybody knows how quickly the alphabet can be repeated forward, and also that it takes longer to repeat it backward—how much longer we do not usually realize. Repeated experiments with college classes have shown me that it takes about three seconds to say it forward, and thirty seconds to say it backward. Great difficulty, and even painful tension, are experienced by most persons who try to say it backward. Also, instead of proceeding smoothly and continuously from Z to A, they are obliged to go a little way, say to R, and repeat it forward, at the same time trying to build up an association in the opposite direction, and then repeat it backward. One who had committed a poem to memory would not attempt reversing the order of words. Only a few words can be spelled backward by most of us. The far-reaching importance of this principle is, however, too often unappreciated and violated. The teacher gives the child the combination $7 \times 8 = 56$, and is amazed when the child cannot tell that $8 \times 7 = 56$. The brightest children may happen to reverse the combination, and thus hit upon the right answer, while the rest fail and are called stupid. It is a case of pedagogical blundering on the part of the teacher rather than stupidity on the part of the children. 7×8 is not the same as 8×7, any more than *c-a-t* is the same as *t-a-c*. $8 + 7$ is not the same process as $7 + 8$; $36 \div 9$ is not the same as $36 \div 4$; $\frac{1}{2}$ of 4 is not the same as $4 \div 2$, or $2/4$ of 4. To make the child see the equivalences, and learn the different combinations, is a part of the teaching process. They are not usually seen by the child until pointed out.

In teaching foreign languages this principle is frequently overlooked. The usual procedure in the translation method is to have the pupil look at the foreign word and then say the English equivalent. For example, the pupil looks at the word

Knabe and says *boy, Mädchen* and says *girl, livre* and says *book, chien* and says *dog,* etc. Is there any wonder that the pupil does not learn to speak the language readily? The chain of association has been from foreign printed symbol to native spoken word, instead of from object or idea to foreign spoken word. In many classes the pupils seldom read the German, always translating. Thus the ear never becomes accustomed to the sound of the foreign language. Still less are there associations built up between idea, spoken foreign word, and printed foreign word. While in Germany, as a student, I noticed that many American students always tried to take notes in English on the lectures, given in German, of course. As a result, those students never learned to understand the lectures well. It is almost unnecessary to add that they never learned to speak German. They constantly heard one language and thought another. As a result, both processes were hindered. The students who went into the lectures and began taking down in German as much as possible, if only a single word or an isolated sentence, soon became accustomed to grasp the thought and to record it in the same language. Their progress was decidedly faster than that of those who resorted to translation methods.

I have frequently tried the following experiment with classes: (1) A list of German words is given to be translated at sight into English. The time is taken and the number of mistakes is recorded. (2) A list of English words, equally long and of the same difficulty, is given to be translated at sight into German. The time necessary to translate the list from German into English is always much less than when the translation is from English into German. The latter often takes twice as long, and more mistakes occur. The result is a perfectly natural one. Ease and rapidity of functioning is a consequence of frequent associations. The way in which experiences are registered determines largely the manner of their recall. The existence of this physiological and psychological law is the justification for treating association as a part of memory. From the practical

stand-point of the teacher we are deeply desirous of having experiences assimilated in such a way that they may be serviceable at subsequent times. The accuracy and facility with which they recur is dependent upon the manner in which they were recorded.

Mechanical or serial associations are formed in learning such combinations as the alphabet, rhymes, jingles, or any combination of words in a serial order. Any such process may be represented by *a-b-c-d-e* in which *a* serves to call up *b*, *b* calls up *c*, *c* calls up *d*, etc. (See Fig. 30.) No given element can be called up easily save by the previous element as a stimulus. Ask a class suddenly what letter precedes *m*, and they are either very slow in answering, or give a wrong answer. Complex associations are formed when the order is not always the same,

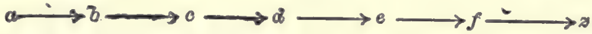

FIG. 30.—Diagrammatic representation of mechanical or serial association.

and when many elements become associated with each element. Not only are the elements as *a-b-c*, connected serially, but each element is connected with every other element. Each one of the given elements then serves as a stimulus suggesting the recall of any and all of the others. The chances of recall are thus very greatly multiplied.

The accompanying diagram (Fig. 31) may help to understand the effect of multiple associations. The various letters on the circumference of the circle may represent the various items of experience which become linked with each other in manifold relations. Gradually they group themselves around some central theme, represented by *o*. The circumference may represent the unification and binding of all into a *unified, complex thought-whole.*

Laws of Association.—Most psychologists state several laws of association which are designed to show why certain ideas have clustered about them a series of certain other ideas. The explanations are usually based upon the character of external objects or the order in which they have been experienced by us.

Some of these laws are called those of contiguity (in space or in time), similarity, contrast, cause and effect, etc. There is, however, only one fundamental law of association, namely that of *coexistence in experience.* Experiences which have been registered together become associated and tend afterward to persist in the original relations. Chance coexistence in space or time, similarities, contrasts, or causal relations between phenomena do aid in making associations, but until the registrations are made there are no associations. Whenever any of

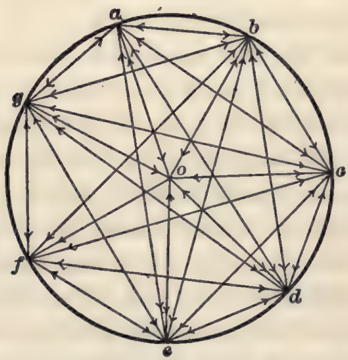

FIG. 31.—Diagram representing a complex of associations and their unification.

these factors produce or promote recall it can be assumed that some elements have previously been registered together.

Purposive Associations.—In order to have things recalled it will not do to trust to chance associations that are expected to be formed because things may be near together in space or time. Every-day illustrations may be given to show that mere chance contiguity in space or in time is not sufficient to produce an association in the mind. A class of forty were asked to tell the number of the class-room in which they had assembled three times every week for six months. Not one was able to answer correctly. They were asked to draw a dog's foot and a hen's track as they appeared in the snow or in the mud. The drawings were far from accurate, some drawing three toes and some five

toes for the hen's track. Those were objects of frequent casual observation, but because no attention had been paid to them, no definite associations had been formed. That the associations had not been formed better was no discredit, but it shows us that in all teaching associations must not be left to chance. By questions, by analysis, by careful explanations, and by requiring concentrated thinking, pupils must be led to form definite associations and not be passive recipients of isolated facts. Careful questioning produces new ideas, new combinations of thought, *i. e.*, new associations, thus increasing the number of suggestions and the probability of recall.

When a given idea has been associated with several others, it is of interest and importance to know which will be recalled when it comes before the mind. It is of still more immediate interest to know how to weld associations so that the experiences can best be retained and recalled when needed. Although the stream of thought is to a large extent determined by chance associations, it is also true that the most desirable associations are not made without conscious effort. The child, for example, gains in a desultory manner from his environment, many ideas about nature, art, social laws, and economic relations. The knowledge thus obtained is sometimes so much overestimated that it is not deemed necessary to study these facts and phenomena in a systematic way. While environment is exceedingly potent in shaping one's ideas, we must not forget that there are many with eyes who see not, with ears who hear not. The country boy with a vast wealth of natural phenomena all about him is too often completely deaf and blind to their richness. It is not at all uncommon to find bright country boys of sixteen who do not know as many birds and other animals, trees, flowers, and varieties of rocks and soils, as the city high-school boy who had early in the grades been taught to observe these things. The country boy has wonderful possibilities, but is often without wise guidance. In order to produce associations, the more purposeful the effort, other things being equal, the better the associations will be made.

Vividness.—Events which have come to us in so striking a manner as to transfix the attention are indelibly impressed upon the mind. An accident, the first sight of the great ocean, the first trip to a metropolis, a visit to Mammoth Cave, a descent into a coal mine, a balloon ascension, a fright from an encounter with wild beasts, or a railroad accident can never be forgotten by the one who has had the particular experience. Similarly it is not uncommon to be put into possession of certain facts in such a way that they will never be effaced. The demonstrations in physics performed by a certain professor come back to me now in great detail, after the lapse of nearly a score of years since witnessing them. The first wonders of experimental psychology came to me so impressively that I could now tell every detail of the experiments performed more than a dozen years ago. Is it not a truer function of teaching to open up the wonders of the universe, both of nature and of art, with the utmost vividness, than to drill mechanically a traditional set of facts into pupils' minds?

Ideas should be made as vivid as possible in order to establish associations thoroughly. The advertiser seeks to arrest the attention and compel the mind to contemplate the thing advertised. In order to do this, striking pictures, brilliant colors, bizarre figures and situations, are employed. Besides being designed to compel attention, a successful advertisement must set forth the most tempting features of the advertised wares. Enough must be given to make the observer curious to know more. The good teacher is a good advertiser. He presents ideas in striking ways and at opportune times so as to stimulate curiosity.

Attention and Association.—Though the nervous system of the child is plastic and his senses keen, yet the majority of his perceptions leave little definite trace. This is because he cannot concentrate all his forces upon the facts under consideration, and because his ideas do not sprout out and become related to all other germane ideas. Attention not only means the ability to focus the mind on a single point, excluding extraneous

ideas, but also the ability to secure a grasp on everything that can contribute to the complete understanding of the given idea. It is like the abilities of a strong executive. He must not only be able to work hard and effectively himself, but he must be able to marshal great forces to exert their utmost aid in the same direction. In a great act of attention the mind is not merely fixed in one direction, oblivious to all else, but it is searching this way and that to discover and establish all possible integral relations. The child's inability to attend is explained largely through his lack of apperceptive material. Therefore when we speak of attention as a factor in association we mean that associations are deepened thereby, and new ones formed, thus increasing the possibility of recall. The lowest sort of attention is employed in strengthening mechanical associations, the higher in establishing thoughtful ones. The former is necessary in teaching the child to recognize word forms, to spell, or to fix the addition table and the multiplication table. As long as he is swaying about, looking out of the window, or counting his marbles, he cannot fix the word forms. He must be brought to see with sufficient attention to effect a change in his cerebral ganglia. On the other hand, in order to register ineffaceably algebraic principles and scientific truths, the attention must command all the individual ideas in such a way that they are apprehended and comprehended, until every appropriate relation is established. To accomplish this, each new fact must be scrutinized and made to fit into the system necessitated by all the kindred facts. This *relating activity* is coextensive with the higher form of attention, and ensures the most valuable associations.

When there is an attempt to make artificial associations in a mechanical way, as in learning foreign languages, the names and locations of various geographical features, or a series of historical data, there is often no interest in the process, and the results either become confused or soon disappear. Experiences do not become deep and permanent without undivided attention. Genuine attention is only possible when there is a full

headway of interest. Frequently insufficient time is given to make associations permanent. A flash-light may disclose an interesting scene, but before the mind has had time to dwell upon its contents it is passed by for another one. The succession of views becomes confused. Similarly with the multiplicity of things which often engage the school-child's attention. He flits from study to study, and from topic to topic, so rapidly that no idea has a chance to be recalled or contemplated. When we consider the number of topics that a child is frequently expected to learn in history or geography in a year, the surprise is not that he forgets as many, but rather that he retains as many as he does.

Repetition of what has been learned is an important factor, especially in mechanical memory. The association paths are to be deepened, and the oftener the ideas are recalled in the same order the better the retention. Here again the psychology of advertising has abundant suggestiveness. No one can help knowing the particular merits of Ivory Soap, Pears' Soap, Rubifoam, Sozodont, Peruna, Walter Baker's Cocoa, Swift's Premium Hams, Quaker Oats, or Heinz's Pickles. They have been inescapable. We encounter their compelling pictures and persuasive phrases in every newspaper and magazine. We cannot turn a street corner, or glance out of a car window, or even withdraw our glance to car interiors, without encountering some of these "ads." In season and out of season, whether we will or no we are bound to meet them. The teacher may well take a hint. Some of the arts most worth striving for can be taught by the same process. Take language, for example. How else will the child ever develop correct speech except by hearing it, seeing it, and feeling its power during every minute of the school day, and properly in the home? The child who hears correct speech only in the language class will never acquire it thoroughly. Morals and manners must be taught in the same fashion as correct language. If good examples are advertised on Sunday only, the intervening week-days will obliterate all traces.

The Observance of Natural Relations is always an excellent means of fixing associations. The coexistence in time or space of objects or events that regularly occur in such relations, when observed, is an aid in fixing the association. This is true because when once the relations are observed the coexistent factors are frequently brought before consciousness. Such phenomena as thunder and lightning, warm weather and growing vegetation, cooling atmosphere and condensation of moisture, change of temperature with change of thermometric reading, being causally related, become easily impressed upon the mind when once the relationship is observed. However, as was previously pointed out, the mere fact that relationships exist between objective things is no guaranty of their being observed and recorded together. As further examples, it might be mentioned that the relation between forests and rainfall has only recently been observed; the circulation of the blood is a new discovery; the bacterial theory of disease not a half-century old. A pupil would be a long time independently discovering the relations between varieties of soils and adaptable crops; though when once understood they become indissolubly connected. Just so with multitudes of facts in geography, science, and history.

The import of this paragraph is to emphasize the necessity of forming systematic, logical, and causal relations among series of facts rather than depending upon artificial associations. The natural relations are more apt to be forced upon the mind repeatedly. Too much of geography teaching and history teaching is made to depend upon absolutely mechanical associations, when everything could be presented in a connected series of thoughtful relations. There are some things desirable to learn which must be largely isolated, but the majority of all knowledge, whether in school or out of it, can be so grouped as to become woven into logical relations. People's names have no logical relation to their possessors, but when we come to know the individual thoroughly, his habits, his temperament, his home, his associates, and his capacity, the name becomes so complexly

associated with the individual that a multitude of suggesting strings may be pulled, any one of which will recall the right name. The case is far different with the child in learning the list of capes on the coast of America, or the boundaries of each of the States. In these cases there is only one sort of association, and that purely artificial and mechanical. When the child learns rules in arithmetic or grammar without comprehending them, the associations are purely arbitrary and mechanical. When we shall have become entirely free from such atrocities committed in the name of education, a day of rejoicing may be proclaimed.

Similarity of Objects.—It has been vigorously argued by some that here we have an elemental law, correlative with contiguity in experience or even still more basal. I regard it, however, as being reducible to contiguity in experience. That two things are similar is no evidence that they will become associated in our minds, or that the appearance of one will recall the other. These occur only after the similarity has been discovered and the relationship established. A gas-jet and a foot-ball are, in certain respects, similar to the moon, the former in luminosity, the latter in rotundity; but few would associate them unless the similarity had been pointed out and dwelt upon. If we employ the term similarity, we must make it include similarity of relations and not alone similarity of appearance. Thus, all vehicles are similar though they differ vastly in appearance. Similarity between governments, customs, physical processes, modes of transportation, etc., would all be included. Correlative with the establishment of ideas of similarities should be a search for contrasts. That this is frequently done is attested by the fact that we have built up in our minds many pairs of contrasted words, such as, good and bad, heat and cold, long and short. It could be shown, however, that these are built up only through experience. They do not become united spontaneously.

Professor James repudiates the belief of the older psychologists that similarity is an elementary law of association. He retains the term merely because of its traditional use, but rejects

its former meaning. Titchener says:[1] "In the older psychologies we read of various 'kinds' of association: association by contrast ('giant' suggests 'dwarf'), by similarity ('Dickens' suggests 'Thackeray'), by contiguity ('sea' suggests 'ships,' because the two are seen together), by cause and effect (the riven oak-tree suggests the lightning that struck it), by means and end (the idea of keeping our clothes unspoilt suggests the taking of an umbrella with us when we go out), and so on. It is clear, however, from what has just been said, that these are not 'kinds' of association—there is only one kind—but merely forms of it, arranged for convenience under certain heads." The only reason why similar objects suggest each other is that each contains some elements which are common and which have been experienced before. Students have frequently said to me, "But we met an entire stranger *A* who reminded us of a friend *B;* how can this be explained by contiguity in experience?" The answer is as follows:

Let the two persons be represented by the following scheme:

$$A\left\{\begin{array}{l} \mathrm{m}\\ \mathrm{n}\\ \mathrm{o}\\ \mathrm{x}\\ \mathrm{y}\\ \mathrm{z}\end{array}\right. \qquad\qquad B\left\{\begin{array}{l} \mathrm{m}\\ \mathrm{c}\\ \mathrm{d}\\ \mathrm{e}\\ \mathrm{f}\\ \mathrm{g}\end{array}\right.$$

m, n, o, e, f, etc., represent characteristic features of each person. The two persons, *A* and *B*, are different in all characteristics except one. Now, with what has this one characteristic, which you have seen in the stranger, always been associated? With *A*, and by the law of coexistence in experience it will now be referred to its usual associates. The two wholes may never have been experienced together, but the single element common to both has been frequently experienced and always with *A*. Consequently, when again observed, even though in a new combination, *B*, it is immediately referred to the old familiar association series, *A*. Therefore the new whole, *B*, with the one

[1] *A Primer of Psychology*, p. 131.

familiar element suggests and serves to recall the old unit, A, which contains the one familiar element.

Association in all Experiences.—When thinking of the pedagogical applications of association we must not overlook the multitude of every-day associations that we do make and should make. Our search must not be for those extremely artificial associations we sometimes make in the school work, like, for example, the association of the letters *v*, *i*, *b*, *g*, *y*, *o*, *r*, with the arrangement of the colors of the spectrum, or "lower and lighter and heavier and higher" with the barometric record, or the year 1066 with the six Johns. Every act of perception, every process of imagination, every complex memory process, involves the formation of associations, and also involves associations previously made. Every recall in memory, every judgment we form, every act of reasoning, every emotional thrill that affects us, depends upon past associations. Association is no occasional visitor; it is an ever-present guest; is always with us, bidden or unbidden.

When we learned to walk it was only by associating a certain amount of muscular tension in one part with a certain amount in another, the association of these with so much space covered, so many bumps received or avoided, and the co-ordinating of all these into the process of walking correctly, easily, automatically. Not until habit had perfectly established the associations and co-ordinations did the process become at all perfect. While the habit was in the making, the process was awkward. Learning to talk is but a process of learning to associate ideas of objects and actions, sounds of words, and muscular movements of the vocal organs. The child very slowly associates the object with the word as heard. Many repetitions are necessary to establish the habit of thinking that connection. Still longer does it take to associate the movements of talking with the sound and the object. Learning a foreign language is a process of association, as are learning to read, to write, to spell, to sit, to skate, to dance, to know various objects and their uses.

In fact, as James says: "Your pupils, whatever else they are, are at any rate little pieces of associating machinery. Their

education consists in the organizing within them of determinate tendencies to associate one thing with another,—impressions with consequences, these with reactions, those with results, and so on indefinitely. The more copious the associative systems, the completer the individual's adaptations to the world." The function of the teacher "is mainly that of *building up useful systems of association* in the pupil's mind." [1] He writes further: "In working associations into your pupils' minds, you must not

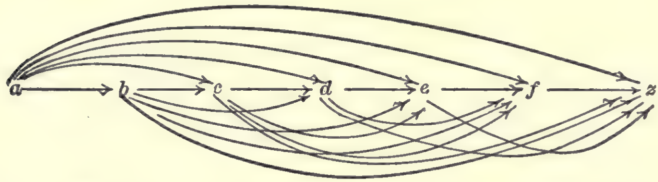

FIG. 32.—Diagrammatic representation of the associative relations between each element and every other element in a mechanical associative series.

rely on single cues, but multiply the cues as much as possible. Couple the desired reaction with numerous constellations of antecedents,—don't always ask the question, for example, in the same way; don't use the same kind of data in numerical problems; vary your illustrations, etc., as much as you can." [2]

In a train of mechanical associations it has been indicated that the association is directly between a given element and the one succeeding it, as *a-b-c*, etc. It should be noted, however, that there is a certain relation established between each of the elements and all the others. This may be represented by the diagram (Fig. 32). It is the entire thought-train which is related, and not only the immediately adjacent elements. Were this not true, our memories would often play us queer tricks. Suppose we had memorized the two following lines as suggested by James:

I, the heir of all ⟩ the ages ⟨ in the foremost files of time.
For I doubt not through ⟩ the ages ⟨ one increasing purpose runs.

[1] James, *Talks to Teachers on Psychology*, p. 82.

[2] *Op. cit.*, p. 89.

Were it not for the fact that each word is linked with the entire thought process, on recalling the lines we should be just as apt to switch from the first line to the second on reaching the common words "the ages." Sometimes such cases occur. I remember that I once switched from one oration to another, entirely different in content, but which had a sentence also used in the first one.

Verbal Associations.—Although we employ words in all our higher trains of association, we often forget the indispensable part that they play in the process. In the section on thought and language it is shown that, although thinking may be carried on without words, the highest forms of thinking necessitate the employment of words. Much thinking is done by means of imagery. This is best exemplified in the case of the lower animals and mutes, though all normal human beings do much thinking in imagery. But only the lowest forms of thinking can be carried on without the use of symbols. Not only are the animals dumb because they are low in mental power, but they are low in mental power because they do not speak. Not only did man acquire language when he reached a certain stage of development, but his development was immeasurably furthered through this acquisition. Language is not only a means of expression, but a means of acquiring ideas. With the words or symbols are associated all the various ideas of sight, sound, touch, smell, taste, muscular tension, pleasure, pain, etc. Take the word ball, for example. The idea of ball includes a great variety of impressions, such as size, color, hardness, and pain or pleasure in catching. The word ball connotes and symbolizes all those ideas. Without words ideas can only be experienced through imagery, a cumbrous process when so complex an idea as home, for instance, is taken. But with the word we have a representation of all the qualities and characteristics known to us. It is the tie that binds. It is thus a means of mental economy and renders possible the formation of concepts.

From the stand-point of the pedagogy of association and memory it is important to urge careful attention to the naming of in-

dividual perceptual ideas, and also to the formation of accurate statements of conceptual notions. Oftentimes teaching proceeds carefully enough in details, but stops short of concept forming and concept stating. The statement of the concept is the symbolic representation of the concept and stands for the whole complex of ideas connoted in the concept. The mind does not need to go over all the details, but is satisfied with the symbol, much as one is satisfied with a bank-note which only *represents* wealth. These trains of thought which can be imagined or built up through actual perception can be carried on without the use of language. But even in ideas that can be perceived or represented through imagery words play a most important rôle. Classification of ideas cannot progress far without recourse to words. All the parts of speech represent classified ideas. No matter whether a word is a common noun, a verb, or an adjective, it represents a complex idea which is brought together under the general class and ticketed with a symbol. These processes of acquiring, arranging, and conserving knowledge are all processes of association. The laws governing them must be understood and followed if education proceeds economically and wisely.

CHAPTER XV

THE WISE USE AND TRAINING OF MEMORY

Upon few other technical questions is the layman so willing to deliver opinions as upon methods of improving memory. He does not feel it hazardous to do so, but regards his conclusions as incontrovertible. The usual advice is to memorize much, verbatim and mechanically. Set apart a portion of every day for committing verses, proverbs, speeches, or strings of dates. It is asserted that the gymnastics thus used will strengthen the memory, not only in the particular direction, but also equally as much in all other directions. It is assumed that *the memory* is a general power, capable of memorizing anything when once developed. On this theory "the memory organ" might be likened to a muscle, the fibre of which can be strengthened by general gymnastics. Let us investigate to ascertain the facts which have a bearing upon the question.

Biological Interpretation.—In the first place, there is no single power of memory which memorizes everything. There is no receptacle which stores all facts of life with equal fidelity. Memory is a dynamic condition produced through experience. It consists of functional relations established in the physical organism or in the mind, which may be awakened by appropriate stimuli. It is more appropriate to speak of *memories* than memory. This view is then opposed to the theory of general improvement through special training. James says that retention "is a purely physical phenomenon, a morphological feature, the presence of these 'paths,' namely, in the finest recesses of the brain's tissue." And further, "*memory being thus altogether conditioned on brain paths, its excellence in a given individual will depend partly on the number and partly on the persistence of these paths.* The persistence or permanence of the paths is

a physiological property of the brain-tissue of the individual, whilst their number is altogether due to the facts of his mental experience. Let the quality of permanence in the paths be called the native tenacity, or physiological retentiveness. This tenacity differs enormously from infancy to old age, and from one person to another. Some minds are like wax under a seal —no impression, however disconnected with others, is wiped out. Others, like a jelly, vibrate to every touch, but under usual conditions retain no permanent mark." [1]

Lloyd Morgan says:[2] "Retentiveness is, in fact, to a large extent a psycho-physiological datum; something given in the brain-structure and mental character of each individual; something which we can no more alter than we can alter the size of our heads, or to take what is *perhaps* a closer analogy, the size of our muscles. By careful use and training we may develop our muscles within the limits assigned to them by nature. So, too, by careful exercise we may perhaps develop our retentiveness within the limits assigned to it by nature."

One of the most important discoveries concerning the memory, therefore, is that the native capacity for retentiveness in a given individual is unchangeable by training, and is only modifiable by a change of health, by changes in nutrition, and by changes incident to growth and development at different ages. This statement is not intended to mean that one cannot improve certain factors of memory, or that memory as a means of acquisition cannot be greatly enhanced. But the mere capacity for conserving impressions of a given intensity, duration, and without associations cannot be increased by training. This hypothesis has been tested at several times and seems now to be well established as a fact.

Experimental Evidence.—Professor James mentions several experiments that were made in testing the validity of this hypothesis. He says:[3] "In order to test the opinion so confidently

[1] *Principles of Psychology*, I, pp. 655, 659.
[2] *Introduction to Comparative Psychology*, p. 107.
[3] *Principles of Psychology*, I, pp. 666–668.

expressed in the text, I have tried to see whether a certain amount of daily training in learning poetry by heart will shorten the time it takes to learn an entirely different kind of poetry. During eight successive days I learned 158 lines of Victor Hugo's 'Satyr.' The total number of minutes required for this was $131\frac{5}{6}$—it should be said that I had learned nothing by heart for many years. I then, working for twenty odd minutes daily, learned the entire first book of 'Paradise Lost,' occupying 38 days in the process. After this training I went back to Victor Hugo's poem, and found that 158 additional lines (divided exactly as on the former occasion) took me $151\frac{1}{2}$ minutes. In other words, I committed my Victor Hugo to memory before the training at the rate of a line in 50 seconds, after the training at the rate of a line in 57 seconds, just the opposite result from that which the popular view would lead one to expect. But as I was perceptibly fagged with other work at the time of the second batch of Victor Hugo, I thought that might explain the retardation; so I persuaded several other persons to repeat the test."

Dr. W. H. Burnham, who tried the same method, learned for 8 days previous to training 16 lines of "In Memoriam" each day. This required 14 to 17 minutes daily, average $14\frac{3}{4}$ minutes. As training he committed daily for 26 consecutive days Schiller's translation of the second book of the "Æneid." This afforded an entirely different kind of material from the preliminary test. Returning to "In Memoriam," he found the average time for 16 lines to be $14\frac{27}{48}$ minutes—maximum 20, minimum 10. Mr. E. A. Pease made a preliminary test on "Idyls of the King," then trained himself on "Paradise Lost" (length of time and daily amount should be given, but are not). The average time for a given number of lines in the 6 days preliminary to the training was $14\frac{34}{60}$ minutes, for the test after training, $14\frac{55}{60}$.

In order to bring the matter before my students in a concrete way, I persuaded two of them to undertake a series of experiments, covering in one case 35 days and in the other 50 days.

Five days in each case were taken for the preliminary tests, 5 for the final tests for comparison, and 25 and 40 days respectively for the drill. The preliminary tests consisted in the memorizing of miscellaneous matter, such as lists of nonsense syllables, lists of figures, selections of poetry, pieces of prose of varying degrees of difficulty, one being from Harper's *Fourth Reader* and the other from Hering's *Memory*, a list of twenty titles of unfamiliar books, and the names on a series of bottles holding chemical reagents. Each test was concluded as soon as any fatigue was noticeable. They thus varied somewhat in length. Only one test of a kind was taken at a given sitting, and the tests were throughout so varied and unexpected in character to the student that there was no possible chance for the effects of practice to enter into them.[1] Both of the students were unfamiliar with chemical nomenclature, and the labels were partly in words and partly in symbols, *e. g.*, HNO_3 and *Hydric Acetate.* When learning the list of unfamiliar book titles, only the backs of the books were exposed, so as to shut out as many associations as possible of names with books. It was, however, rendered easier by the sizes and colors than a list merely written or pronounced. There were 25 nonsense syllables in each list, and the number list contained 47 digits, arranged so as not to be in a serial order. Each was to be learned as a separate number. Thus there were tests in which as many associations as possible were removed, lists in which as many association helps as possible were included, and then intermediate lists. (Instead of figures and letters, arbitrary characters and forms might perhaps have been given to be drawn, and arbitrary sounds might have been uttered to be reproduced. This would have excluded association still more.) A list was regarded as memorized when it could be repeated or written (as the student chose), with a minimum number of mistakes —omissions, transpositions, or substitutions. It would have

[1] In James's tests it seems as if practice on the preliminaries and finals might affect the results. He discredits two other series recorded by him in which the preliminary practice and finals occupied fifteen and sixteen days respectively. See *Principles of Psychology*, I, p. 667.

been interesting to determine how much could have been reproduced after certain lapses of time. This was contemplated in the beginning, but, in the press of other duties, after being only partially completed, had to be abandoned.

One of the students, after the preliminary results, trained herself for 40 days by committing for 20 minutes daily parts of Tennyson's "In Memoriam," learning the introduction and 17 sections. The other student took for her memory gymnastics 30 minutes daily of mechanical memorizing, which she was able to continue 25 days. She did not drill on one form of composition, but alternated, according to interest, between prose and poetry. The final tests for comparison with the preliminaries were of the same kind and amounts, and given under the same conditions, as the preliminary tests. The lists of nonsense syllables, digits, book titles, chemical labels, etc., contained the same number as in the corresponding preliminary test, and the material for continuous discourse was from the same selections as used in the preliminary test.

On comparing the results "before taking" and "after taking," and considering all conditions, both of the students voluntarily stated in written reports of the experiments that they believed James was right. In some parts of the tests subsequent to the practice, slight gains were shown. In some others losses were disclosed, and in others no changes. The gains were more numerous, but the losses greater in amount than were the gains. For example, student A committed 267 words of poetry in 30 minutes before practice, and only 189 words of the same selection after practice. Student B committed 260 words of poetry in the same period before practice, and only 200 after practice. In one case 47 digits were learned in 15½ minutes before practice, while it took only 10½ minutes after practice. Neither the gains nor losses have any special significance. The gains are more noticeable in the purely mechanical forms where methods of learning could be standardized. The variations probably represent different conditions of the learner. The gains ought to predominate over the losses with no other influ-

ence than that of the discovery of the best methods of learning the particular kind of material. A slight gain from this source ought to be expected. Such gain would not contradict James's position. In all of the instances where gains were shown, the students explained that they had been able to acquire a peculiar knack or trick of grouping the materials. It was also true, in the same cases, that more mistakes and more substitutions occurred, and the subject did not feel so sure of the results. In the cases of the book titles both students said that it happened that a few partially familiar titles came in the second list and none in the first.

Since James published his conclusions, which seemed somewhat startling at the time, a great many experimental investigations have been made under strictly scientific laboratory conditions. The most important of such investigations are indicated in the footnote.[1] While some of the results, especially those of Meumann, show that some gain follows after considerable practice in memorizing a given kind of material, it is to be noted that the gains are usually found in connection with the purely mechanical types of memorizing. "It will also be seen," says Pillsbury,[2] "that there is a tendency for the gain to be greatest in material that is most closely related to that on which the practice was obtained." These might be expected, and indicate, not any special change in a general ability, or a transference, but a gain in the method of learning. Fracker found some slight gains in some tests, in others none. He is of the opinion that there is only a limited spread of training, and that all "transference depends upon the nature of the imagery employed in

[1] Meumann, *Arch. f. d. gesam. Psych.*, vol. IV; *Grundfragen der Psych.*, chap. on "Übungsphänomene des Gedächtnisses," Leipsic, 1904; "Vorlesungen zur Einführung in die Experimentelle Pädagogik," Leipsic, 1907; Müller u. Pilzecker, "Experiment. Beiträge zur Lehre vom Gedächtnis," *Zeitsch. f. Psych. u. Phys. d. Sinnesorg.*, 1900; Binet et Henri, "La memoire des mots," *Année psychol.*, I, 1895; Bolton, T. L., "The Growth of Memory in School Children," *Am. Jour. of Psych.*, 1892; Shaw, "A Test of Memory in School Children," *Ped. Sem.*, 1896; Henderson, E. N., "A Study of Memory for Connected Trains of Thought," *Psych. Rev.*, *Monograph Sup.*, No. 5, 1903; Lobsien, "Über das Gedächtnis, u. s. w.," *Beitr. z. Psych. der Aussage*, II, 1906.

[2] *Educational Review*, June, 1908.

practice, rather than upon any other factor."[1] The materials for the test, in all the investigations that have come to my notice, are quite similar for the practice and the comparisons. Meumann has been quoted widely by opponents of the position taken by James, because Meumann has found such definite gains. He attributes the main gain to similarity of elements in the different materials memorized, and to improvements in methods of learning. He also believes that there was some training of a common capacity for memorizing. Pillsbury[2] says, "This does not seem to me to be a necessary conclusion, for no one knows how the gain due to these secondary factors stands to the total amount of improvement. One cannot be sure, therefore, that all of the gain is or is not to be explained in terms of the change in these capacities that are generally assumed to be susceptible of training." The words of Meumann should be quoted in this connection. He asks the question whether *Lernfähigkeit* (power of learning) or *Behalten* (retention) is the more modifiable by exercise? He answers: "The capacity for learning or acquiring! The power of retention appears more as a constant which is determined by the age and stage of development of the individual. The capacity for learning, on the other hand, is a power which depends entirely upon habits of exercise, Retention is conditioned by the gradual unfoldment of the native predispositions of the psycho-physical organism. Learning is more dependent upon the momentary influence of particular forms of exercise in acquisition."[3]

The every-day experiences of life ought to confirm the general idea that the effects of memory training are not very generalized. One has a given type of memory which is apparently very little changed through life. The one who "learns by heart" easily in childhood generally possesses the same type in adult life, and those children who acquire with difficulty, or who forget quickly, usually have the same traits when grown up. If training in

[1] Fracker, "On the Transference of Training in Memory," *Psych. Rev., Monograph Sup.*, No. 38, 1908.
[2] *Loc. cit.*
[3] *Vorlesungen*, p. 201.

special lines produced general improvement, the lessons in arithmetic, geography, and history ought to modify the tendencies to a marked degree. The scholar ought also to have a vastly better memory than the unschooled, but on matters of equal comprehension to both, the scholar possesses no advantage over the one without the long years of training. Again, if there were a general transference of effects, no individual ought to have varieties of memories for different things; but such are very common characteristics of individuals. In abnormal conditions memory may be lost for one kind of speech and not for another. If there is a uniform transference of effects, why could one disappear and leave the others unaffected? In normal life the individual variations are often very marked. One distinguished scholar of my acquaintance, with exceptionally keen general powers of learning and of retaining ideas, never can trust himself to quote a line of poetry. He quotes prose with perfect accuracy. He also has no musical memory. His special field of scholarship is language. My own power of remembering names and addresses is something out of the ordinary, while I have never been able to commit to memory either poetry or prose without the greatest difficulty.

The modern doctrines of physics, biology, and psychology all ought to teach us that life is a unity and that, therefore, education of one power of body or mind ought to affect, in some degree, other parts of the organism. The same sciences, on the other hand, ought to teach just as definitely that all organs or powers of an organism, while completely interrelated and a part of the unity of forces, are still in a great measure independent. The development of one part energizes the entire organism to some extent, but by far the greatest effects inhere in the part directly affected.

From the pedagogical point of view it ought to be thoroughly apparent that the general type of memory of a given individual is little modifiable by training; and further, that acquisition of facts in a given line for the purpose of general gymnastics is an utterly untenable position. "Suffice it to say," says Pillsbury,

"that memory for any range of facts will be trained more completely by practice in that field than in some other, just as training in rowing is more effective in that sport than in football." Miss Gamble writes,[1] in the latest deliverance on the subject, after a very long experimental study, that: "It is probable that practice is transferable only within very narrow limits. It is probable also that one's 'brute retentiveness' cannot be improved by training. Nevertheless, it is certain that a very great difference can be made by training in what one can do with one's brute retentiveness along specific lines."

Health and Memory.—The previous discussion of retention indicates that retentiveness is a physiological phenomenon, depending upon nutrition for its permanence. This being true, it is evident that whatever seriously interferes with fundamental states of bodily health must affect the processes of memory. Pedagogically this must be considered with reference to both the registration of facts and their attempted recall. A few facts will confirm the foregoing conclusions. "A young woman, of robust constitution and good health, accidentally fell into a river and was nearly drowned. For six hours she was insensible, but then returned to consciousness. Ten days later she was seized with a stupor which lasted for four hours. When she opened her eyes she failed to recognize her friends, and was utterly deprived of the senses of hearing, taste, and smell, as well as the power of speech. . . . She had no remembrance from day to day of what she had been doing the previous day, and so every morning commenced *de novo*. She gradually, however, began, like a child, to register ideas and acquire experience. . . . But every day she began something new, unless her unfinished work was placed before her, forgetting what had been done the day before."[2] Some twelve months later her bodily and mental health were restored and she regained her vocabulary and her senses, though very gradually. The year

[1] "A Study in Memorizing Various Materials by the Reconstruction Method," *Psych. Rev., Monograph Sup.*, No. 43, p. 210, 1909.

[2] Ribot, *Diseases of Memory*, p. 90.

was a period of complete oblivion. This shows that the accident not only caused a cessation of normal recall of the previous experiences, but also that the registration during that period amounted to practically nothing for her subsequent life.

Carpenter relates[1] that Sir Henry Holland, an English physician, while visiting the mines in the Hartz Mountains became over-fatigued and, as a consequence, suddenly forgot all his knowledge of German. Holland wrote: "I descended on the same day two very deep mines in the Hartz Mountains, remaining some hours underground in each. While in the second mine, and exhausted both from fatigue and inanition, I felt the utter impossibility of talking longer with the German inspector who accompanied me. Every German word and phrase deserted my recollection, and it was not until I had taken food and wine, and been some time at rest, that I regained them again." Halleck says: "A professor gave the same extempore lecture on two different days; the first time at 11 A. M. He then showed easy mastery of his subject, and he held the attention of his audience easily from first to last. The second time he began speaking at 4 P. M., and he never once seemed to be master of the subject, although he was evidently laboring very hard to be impressive. Many of the audience were yawning and shifting their positions. In commenting afterward on his feelings that afternoon, he said that he had never experienced a sense of greater effort, that instead of the ideas flowing from him easily and naturally as on the morning of the previous lecture, he had to take a cudgel and drive them all out of the cave in which they seemed to be endeavoring to conceal themselves."[2] In my own case I was once so situated that I gave the same classwork in three successive sections. On several occasions where I had given an extempore lecture to the first two sections with ease and without difficulty in finding topics and appropriate words, I came near breaking down in confusion in the third section,

[1] *Mental Physiology*, p. 441.
[2] *Education of the Central Nervous System*, p. 65.

through inability to recall my points or the words in which to illuminate them. This result was due to sheer exhaustion.

Attention, Concentration, and Memory.—Halleck says: "A study of the physical aspects of attention is necessary in order that we may do the most effective mental work. If we notice ourselves carefully, we can often detect a distinct physical strain in attention. If we innervate our ears to catch the first sound of a coming footstep; if we continuously follow the flight of a bird across the heavens; if we pass our fingers over various fabrics to detect a difference,—we are conscious of a physical tension, which, if unintermitted, produces fatigue." [1] Attention produces not only the same chemical effects and the same fatigue as muscular exertion does, but we feel also the characteristic muscular strain on the occiput, the forehead, and other parts of the body.

Pupils should early appreciate that only with undivided attention can they learn to advantage. They should understand that they need quiet surroundings; that they must be free from disturbances from the outside, and from distracting thoughts from within. Only when the mind is completely centred upon a given problem can it be properly mastered. Any extraneous thoughts of the last night's party, the coming commencement, or the bit of gossip which they would like to retail must all be resolutely avoided. If they would have much time for real enjoyment, due concentration upon the tasks will the quicker insure opportunity for relaxation. Lessons will be learned in less time and more firmly fixed. There is no student habit more desirable, none more often unlearned, and none more difficult to fix than that of undivided attention. Some one wrote that "there is one safe, serviceable, indispensable, attainable quality —that of attention; it will grow in the poorest soil and in its own good time bring forth abundant fruit." Teachers frequently overlook this and omit to provide desirable conditions for concentration. Classes are often required to study in rooms where others are reciting, in rooms adjacent to elevators, or near noisy streets. Even in colleges and universities students are often re-

[1] *Op. cit.*, p. 66.

quired or encouraged to take voluminous notes during lectures or discussions. They strive to write all the lecturer says and at the same time to understand him. They try to get the lecture to carry under their arms instead of in their heads. A frequent result is that the ideas are left vague and the incomplete transcription proves as meaningless as Chinese when referred to just before the examination.

Much attention has very properly been given to the details of the recitation; but altogether too little thought has been directed toward adequate facilities for study hours and their proper observance. Pupils are frequently required to learn lessons outside of school. In a great majority of cases they have the most unfavorable surroundings for the pursuit of such work. They have to study in the general living-room, a small table only is provided for the whole family, a single, ill-adapted light is furnished, and the family work, visiting, and gossip are not infrequently carried on simultaneously in the same room. The child can seldom have a light to himself or a table large enough for writing. Every child who has home work should have table space as large as a school desk (and that is inadequate for a real student), and the lamp should not be shared by more than two. Rightly, each child should have his own room where he can be undisturbed.

Proper Study Periods.—Much energy in study is often dissipated because pupils do not know what is to be learned—they do not know what to concentrate upon. Clearness and definiteness in assigning lessons, a due consideration of the apperceptive data already possessed, and proper conditions for study would do more for the recitations than any patent methods of questioning or conducting recitations. Pupils need to be taught how to study in order to accomplish it economically and efficiently. Many of our best educators are coming to insist upon due attention to the proper assignment of work. A considerable part of many recitation periods should be devoted to planning methods of attacking the new problems. Too many teachers regard the class period as a time for pumping the pupil

in order to square accounts. Not infrequently they pump from a dry well. Extreme misinterpretation of the Socratic method of questioning has led teachers to believe that they must not instruct or teach, but merely question and record. Their greatest function is to teach and to guide in methods of acquisition. Dutton says: "Supervise the study periods. The teacher who asks his pupils to study, and then proceeds to write letters or make up his reports, is not only losing an opportunity, but is violating his trust. He should be at the service of his pupils, passing around from one to the other, giving the needed word of advice or encouragement, making sure that all the conditions for earnest work are as favorable as possible." [1]

Pupils need time to *think*. A high-school pupil once said: "All our time is so taken up with learning our lessons and reciting, that we have no time to think." Alas! is not this indictment too often true? In the hurry of activities, in school and out, with the methods employed, when do the pupils really find time to reflect upon what they are doing? There should be frequent times in the pursuit of every subject when the learner may have time for meditation, sustained reflection, and opportunity for independent organization of the work in his own mind.

I have found it very helpful in advanced classes to assign written reviews to be worked out at home. Some help is usually necessary in organization, but only the main features are suggested and the students are left to give expression to the ideas as they lie in their own minds. This plan necessitates the using of class notes, gathering of materials from collateral reading, and organizing the whole topic for themselves. The topics given out for written organization frequently should not be wholly or definitely covered in the books or in the discussions, but should consider some new relationship growing out of the materials at hand. Sometimes a topic may be studied intensively for a time and then written up during the class period. Such work is the best sort of examination, and has the great advantage of giving

[1] *School Management*, p. 171.

opportunity for deliberately organizing thoughts, and the formation of multiple associations. A necessary prerequisite of all memory of real ideas is just this associative reflection.[1]

Multiple Associations.—Many diverse associations are necessary to secure the best memory. The more numerous and diverse the associations connected with a given fact, the more possibilities of its recall. Each experience becomes a "suggesting string" which may be pulled to induce recall. There is great danger that associations will be too few, and of the purely mechanical type. The way in which the ordinary text-book history is studied illustrates the point. The number of topics is large because the historian feels compelled to give a complete account. This necessitates great brevity of topics, usually at the expense of clearness. Furthermore, this condensed compendium frequently necessitates giving as much space to comparatively unimportant events as to those which are of vital significance and which should be expanded according to their importance. An actual count shows that average school histories contain about fifteen hundred topics, any one of which would furnish several days' lessons if studied sufficiently to be clearly comprehended. The entire fifteen hundred, however, are frequently forced kaleidoscopically before children in about two hundred and seventy lessons. What wonder that the whole subject is but a confused blur in the minds of the learners? If a few leading topics were selected and then studied deliberately from many sides until thoroughly comprehended, the resulting product would be infinitely more valuable. With the abundance of collateral material easily obtainable, every lesson ought to be illuminated by the teacher, and by means of other readings, until the pupils see the actors face to face, instead of through a glass darkly. What boots it if the entire book is not covered? Not all history is recorded in any one book, and no single author has selected the only events worth while.

The important thing is to have the pupils know how to study

[1] See Meumann, *Ökonomie und Technik des Gedächtnisses*, Leipsic, 1908; also Kuhlmann, *Am. Jour. of Psych.*, 18 : 394.

the subject; to know where to find books and sources that are worth while; and to understand some history so well that it will modify their likes and dislikes, and bias their entire future thinking. Through this they should develop a taste for history and a knowledge of its proper methods of study. If they have not acquired a genuine interest in the narrative of history, the work has been largely unfruitful. If a high-school pupil should spend an hour a day for three weeks reading on the Missouri Compromise or the United States Bank, he would have some ideas so clearly and firmly implanted that he could talk intelligently upon the subject, and moreover he would never forget the salient features. The ideas gained would be so many-sided and the associations so diverse and multiple that they could not easily be forgotten. How different is much of the study of history!

In studying geography it is not necessary that every fact chronicled in a text-book should be taken. The text is usually a compendium for reference. There is no reason why a pupil should take all of the topics, and in precisely the same order as given in the book. Suppose the order is varied and some topics are even omitted? If the topics taken are rendered interesting and clear and full, the method of geographical study will have been impressed and the facts learned will be usable. In order to accomplish these fundamental ends, only a few things can be studied, and these must be taken so exhaustively that no doubt exists as to whether the resulting knowledge consists of words alone or of clear, well-defined concepts gained through concrete individual notions. Usually the book contains only the merest statement of the concept. All concrete details, which are absolutely necessary prerequisites to conceptual ideas, are lacking. Hence the child begins with the generalization which should be the end. The elementary text-book is a good summary, but not an exhaustive treatment of any of the topics discussed. Much of the material for the adequate treatment must be supplied from other sources—by the teacher and collateral books.

We marvel at the politician and the scholar who seem to have

an inexhaustible fund of illustrations and arguments bubbling over for expression. We say, "What wonderful memories!" But outside of their specialties their memories would probably be found as unresourceful as other people's. The secret of their fund of ready recall is easily accounted for by the long study and reflection upon the same thing. Whoever has the perseverance and gives long-continued attention to any line of investigation can acquire a fund of ready knowledge sufficient to enable him to talk continuously upon that line.

Teachers are frequently disappointed in examinations because pupils seem to have forgotten so much that they had supposedly been taught. The wonder is, however, not that pupils have forgotten as much, but that they remember as much as they do. The main reason why they do not remember more is that they have not really learned anything that they were asked to recall. They may have read the words of the lessons assigned and the teacher may have explained, but unless the lessons have become more than words, retention of ideas cannot follow.

Recognition of Varieties of Memory Functions.—The fact that different individuals have different types of memory suggests the desirability of recognizing these individual characteristics in memory training. These should be considered in two ways. First, the one with a special gift in any direction should know how to utilize it; and second, the one who is specially defective in any direction should be helped to remedy the defect, if possible. Use as many senses as possible in acquiring ideas. We should remember that knowledge is very complex, and that a variety of experiences enter into the real and complete knowledge of every concept we possess. For example, the complete knowledge of that classical fruit, the orange, includes taste ideas, those of smell, touch, weight, color, etc. In the case of this particular fruit, most of us have received the actual primary experiences. But in how many cases we are satisfied with getting only a single set of sensations, and then expect that all the other factors will be represented through the fiat currency of words that we employ! The druggist who did not employ several

senses in acquiring his knowledge of drugs would be a dangerous person to compound medicines for us. The successful one relies, not on sight alone, but upon the touch, the odor, the consistency, the weight, sound, etc. Chemistry used to be taught from a book by learning names, symbols, and formulas, without ever seeing a compound. By such teaching a pupil could not tell sulphuric acid from kerosene, or quartz from meerschaum.

Spelling is a process in which sight, hearing, the muscular movements of the arm and the fingers, muscular movements of the vocal cords, the tactile sensation in the hand, joints, and vocal cords, all may and should enter. Unfortunately, unpsychological faddists successively accentuate some one or other of these factors to the neglect of all the others. Each faddist is partly in the right, but all are in the wrong. Ideal results can not be secured in this useful art until the ear is trained to hear the syllables and other component elements, to hear the exact pronunciation as a whole, and the succession of sounds in uttering the letters and syllables; until the eye is trained to see the word as a whole, and in its various analyses; until the muscles of the vocal apparatus are habituated to the utterance of the various combinations; until the hand and arm have formed definite and ready associations of movements; and finally not until there is a perfect harmony and co-ordination among all the various processes. Then only can the spelling of any combination be said to be properly mastered.

Note should also be made of the fact that impressions are not received through a given sense equally well at all times. For example, the ear is used to interpret language symbols several years before the eye. In racial development the ear was for ages the only interpreter of language symbols. This should be recognized in teaching. Early education should be almost wholly oral. The child's language expression should be vocal; instead, he is often plunged into reading as a means of learning, and the hand is set to pen-wagging as a means of expression. Halleck[1] tells us of a class that had struggled hard and long to

[1] *Education of the Central Nervous System*, pp. 48–54.

interpret visually "As You Like It." But they failed utterly to grasp it. It was finally read to them and the change was marvellous. No greater pedagogical heresy is perpetuated at the present time than the atrocious method of instructing little children in singing by note. Instead of giving them an opportunity to hear sweet melodies and then encouraging them, through imitation, to burst forth into songs of praise and gladness, they are required to read a strange, meaningless, Chinese puzzle. The little singing they learn, which is indeed a diminutive quantity, is really gained through imitation of what they hear.

Interest and Memory.—Joseph Cook is said to have written in effect: "Interest is the mother of attention, and attention the mother of memory; if you would secure memory you must first catch the mother and the grandmother." The boy who has no interest in what he does, but goes through his tasks in a purely perfunctory way, does not acquire much, and retains that little poorly. The boy who blunders in his arithmetic, forgets how to spell, and seems to be unable to remember his geography may be, and often is, one who can remember every detail of all the season's foot-ball games. He can name every player who took part in each, remember all the "star plays," the fouls, the bad decisions of the umpire, the different formations that were tried; in fact, like the politician, his fund of knowledge of certain sorts seems inexhaustible.

I once had a boy in school who was called a dunce by many of his teachers, but who knew more about birds than all his teachers combined. Strangely enough, too, most of his teachers had never discovered this interest. A little judicious consideration of this boy's interests which he brought with him furnished a key which unlocked other interests. He did splendid work in nature study, his arithmetic work became the strongest in his class, and, in fact, his work in all lines was second to no other's. The only thing he had needed was an enlistment of his interest. By interesting myself in things that appealed to him, I was able to direct his attention to other things which I thought he should

know. The child who is kept after school to do work as a penalty, remembers well enough his emotions on the occasion, but forgets speedily the lesson imposed. The mind must be in the right attitude, and be a willing party to the operation. The mind that is not aglow with enthusiasm for the task in hand continually wanders away to more alluring fields, attention is scattered, and mental acquisitions are vague, confused, and fleeting. Irksomeness and superficiality of acquisition are natural accompaniments.

Clearness of Ideas.—To record ideas so that they may be permanent, and also that they may be recalled readily, it is necessary to apprehend them clearly. The majority of ideas which come to our minds are so vague and poorly defined that they make little impression and are soon lost. It is a common fault of teachers to lack lucidity in explanation, and text-books are generally very abstract. Limited space, to a certain degree, necessitates this abstractness of text-books, but it is the teacher's business to be concrete and clear himself, and to render condensed abstractions of the text-book clear and comprehensive, when necessary, by copious illustrations. In the lower grades most text-books should serve as summaries of material secured from real presentation by the teacher and from concrete collateral material gathered from necessary books, experiments, and excursions.

Comprehension vs. Apprehension.—The foregoing considerations of memory should teach us much with reference to modes of attempting to secure lasting impressions of various school-room lessons. According to the character of the material, some should be memorized mechanically, while in other lessons no attempt should be made to secure automatic reproduction of fixed forms. In lessons where the content is to be memorized, the efforts of the learner should be centred upon mastering the ideas contained. The attempt should be to understand, to know, and to let memory take care of itself. That which is apprehended in perception, comprehended through apperception, and woven into the warp and woof of mind through manifold

associations will be retained without recourse to artificial memories. McLellan says: "Do not aim at training memory directly, but indirectly, through the training of the apperceiving powers. The attitude of the pupil's mind should be: I must *perceive* this just as it is and in all its bearings; not, I must *remember* this. If the original perception, in other words, is what it should be, accurate, comprehensive and independent, memory may be left very largely to take care of itself. For the first step in remembering anything is to get it within the mind, and apperception is just this getting it within the mind." [1]

A careful consideration of the lessons to be taught, for the purpose of determining just what is to be acquired, and how it is to be acquired, is of prime moment in the teacher's daily plans. Whether a given page is merely a scaffolding which should form a setting to the real structure, or whether it is a part of the structure itself, should be clearly distinguished. Oftentimes many paragraphs must be included merely for the sake of a proper background of the picture which is to be discovered. They are necessary to a complete understanding, but there is no necessity for centring the attention upon them. But the salient facts, principles, and laws should be focalized, crossed and recrossed, viewed telescopically, microscopically, with the physical eye, and through the eye of imagination. Finally, through the highest processes of abstraction and symbolization, the concepts should be comprehended in all their fulness without recourse to the elementary means necessary to the first fundamental ideas.[2]

Modes of Recall.—The function of recall in the learning process is of great pedagogical interest. The recitation has for one function the recall of ideas for the purpose of fixing them in memory more firmly. Under what conditions should recall take place so as to make learning the most sure and economical? Ebbinghaus[3] studied the matter experimentally, in connection

[1] McLellan and Dewey, *Applied Psychology*, p. 95.

[2] For some good suggestions on this and related topics, see Dörpfeld, *The Connection Between Thought and Memory*, tr. by Lukens.

[3] *Ueber das Gedächtnis*, Leipsic, 1885.

with learning nonsense syllables. He found that if the list contained seven syllables one reading would suffice, when the list contained twelve syllables it took sixteen repetitions. Sixteen syllables required thirty repetitions. This suggests the desirability of short lessons, especially with children. After a lapse of twenty minutes he found that fifty-eight per cent. as much work was required to recommit as to commit a new list. After an hour the further loss by forgetting was small. Colvin[1] says, however, that in the case of thought processes, as opposed to forms of expression, when once the idea is learned, recall twenty-four hours after learning is as accurate as immediate recall. This suggests the importance of frequent drills upon things that are to be learned verbatim, but the lack of such necessity when dealing with ideas. For example, the spelling lessson and elementary foreign languages require frequent opportunity for repetition, while the history and nature-study lessons should be dealt with as ideas and will not require much or frequent repetition in learning. The Germans recognize these principles in a practical way in the organization of their school curricula. Latin and other foreign languages are given every day, and sometimes twice a day in the initial stages, while history, geography, and nature study are given about twice a week. The question of review through association and apperception as distinguished from repetitions is more advantageously treated in connection with the subjects of apperception and of thinking.

Kind of Memory to Employ in a Given Case.—It is also important to know whether the form of expression in a given lesson should be learned exactly. There are some things that should be learned verbatim. In these the form as well as the content is important; in fact, in some cases, without the exact form the content would be largely valueless. Among the things which should be firmly fixed in the mechanical memory are the following: The addition, subtraction, multiplication, and division tables; certain tables in denominate numbers; a rich vocabulary of words in the mother tongue; vocabularies in foreign

[1] *Op. cit.*, p. 124.

languages; the spelling of all of one's usable words in the vernacular; some mathematical formulas that are constantly applied in higher mathematics; paradigms in ancient languages or other foreign languages, read only; many gems of literature; occasional definitions; principles, laws, etc.

Except in the case of spelling, tables of the fundamental operations in arithmetic, and certain parts of vocabulary-learning, the processes need not be devoid of thoughtful associations. The multiplication table and much English spelling are, however, as mechanical and content-less as "ickery-irey, ooery-ann"—and must be learned by point-blank mechanical associations. In such cases repetition is about the only way to establish the mechanical bonds of association. In other cases admitting of analysis and thoughtful consideration, the content should be thoroughly mastered before attempting to impress the form of expression on the mind. This should be the invariable rule, for children easily focus upon learning the expression before comprehending its significance. The meaning of all generalizations to be memorized should be taught indirectly, thus coming to the concentrated statement last. Joshua Fitch expressed the matter in a paragraph almost worthy of being memorized verbatim by every teacher. He wrote: "When the object is to have thoughts, facts, reasonings reproduced, seek to have them reproduced in the pupils' own words. Do not set the faculty of mere verbal memory to work. But when the words themselves in which a fact is embodied have some special fitness or beauty of their own, when they represent some scientific datum or central truth, which could not otherwise be so well expressed, then see that the form as well as the expression is learned by heart."[1]

Permanence of Effects.—Whatever has once been memorized and then apparently forgotten, can be recommitted more quickly

[1] For some suggestions concerning the efficiency of various modes of learning, see Colvin and Myers, "Development of Imagination in School Children and the Relation between Ideational Types and the Retentivity of Material Appealing to Various Sense Departments," *Psych. Rev., Monograph Sup.*, Nov., 1909.

a second time than the first. Many experiments have confirmed this view. The most notable experiments were those very patiently and heroically performed by Ebbinghaus. The discussions concerning the permanent effects of experience ought to be of practical pedagogical value. Whatever we have experienced affects us forever for better or for worse. The one who has lived a life of righteousness has built up a fund of acquisitions which will influence or bias his every action and thought. The one who has sown to the winds must reap the whirlwind. Patient, painstaking teachers who have carefully indoctrinated their pupils day by day with noble ideals should not be weary in well-doing, though their work often appears unappreciated or even lost. If the instruction has really made an impression, its influence can never be effaced, though apparently lost in the complex of other experiences. Even in purely intellectual lessons the teacher should take heart. Though the pupil may disappoint on examination day by the apparent effacement of lessons patiently drilled into his mind, the lessons will show somewhere at some time.

McLellan[1] wrote of the permanent effects of experience: "Moreover, from the known connection of mind with brain, there is no doubt that such experiences are accompanied by some modification in groups of brain cells, and that their growth into special organs of apperception is attended with nervous growths which actually modify the structure of the brain. It is not so strange, therefore, that *habit* becomes a *second nature* so strong and active as to be mistaken for the first. This power, bent, facility to act—right or wrong, good or evil—in a definite direction, has *entered into the structure* of both body and mind, and will give coloring to all future thoughts and actions, just as the food-elements absorbed by the tree become a part of its living tissue and affect the assimilation of all material afterward absorbed. Now, the teacher is not wholly responsible for such development of faculty—the powerful influence of environment must be taken into account—but there can be no doubt that,

[1] *Applied Psychology*, p. 71.

under conceivably favorable circumstances, he is, in no small degree, responsible. He can make the child love what he himself loves, and hate what he hates. It is difficult to overrate the far-reaching influences of a teacher of strong personality. Under the teachings of such a man, the child once thinks certain thoughts and is stirred with certain emotions; from that moment he will never again be exactly what he was before; it is, indeed, possible that he will have acquired a bent which will determine his character forever."

Mnemonics are artificial helps used for the purpose of assisting the memory. They usually consist of rules and devices for producing purely mechanical associations. The following illustrations are very familiar: "Thirty days hath September," etc.; "V I B G Y O R"; "Though the rough cough and hiccough plough me through," etc. In ancient times great stress was placed upon mnemonics or *Memoria Technica.* Greek and Roman teachers of oratory made much use of visual pictures in attempting to fix the sequence of topics in mind. They artificially associated the several parts of the discourse with the several parts of a house. In more recent times we have heard of numerous "systems of memory," which the authors guarantee will enable one to remember a book at one reading, absolutely stop forgetting, lead one to the heights of success, etc., etc. As means of memorizing ideas they are a delusion and a snare. Only single, mechanical associations are formed, and these with words, sounds, or some sort of symbols, and not between ideas. If revival is desired, there is only one factor capable of producing it. In the rational memory there are multiple associations and any one of a large number of elements is sufficient to produce recall. In most mnemonic series only the symbols or words are remembered, because the ideas which they represent have never been learned. In the familiar "Thirty days hath September," the chances are that the child learned the lingo and not what it was supposed to help him to remember. Even if he did learn that it was to help him in fixing the number of days in each month, the only means of recall is by unravelling the entire

skein of mechanical elements. Ask him suddenly to tell the number of days in August and he must begin with "Thirty days hath September" and go to "All the rest have thirty-one," etc.

Every system of mnemonics deals with devices for learning things that are not worth learning. Instead of suggesting means of stimulating intelligence, they propose tricks for stultifying it. Stokes[1] unwittingly discloses the perniciousness of all such schemes when he says: "It is *imperative* that a Mnemonical Key should be thoroughly mastered—mark the term '*Mastered*' —I do not say 'understood,' but '*Mastered.*'" He maintains that a pupil "should have a *passive* mind and not audibly or mentally ask fifty questions 'as to the why and the wherefore' of what he is required to do." If the whole business of education were to commit words and mechanical forms to memory that they might be rattled off parrot fashion, there would be *some* value in *some* of the devices. It is questionable, however, whether a rational understanding would not be a quicker, and certainly a surer, method.

Simple devices that one works out, or rather hits upon in studying analytically, are sometimes valuable, but only because they represent relations which we have established for ourselves. Mnemonic devices, necessitating as they do purely mechanical, single connections, are unreliable and generally useless. They disregard the fact that thought relations are the most vital, multiple, and tenacious. If any mnemonic devices are of any value it is not because of the virtue inherent in the device or system. The concentration of attention upon the material to be mastered, and the working out of relations among the different elements, are what cause the retention. However, if one follows some one else's mnemonics it generally requires more time to learn the devices than it would take to learn the thing itself. Besides, if the borrowed mnemonics are followed the means employed in securing the mnemonics are purely mechanical and generally not worth retaining.

[1] *On Memory*, Ninetieth edition, London, 1866, p. 61.

Arrangement of the Curriculum.—In order to make memories permanent and serviceable, ideas should be considered for long periods of time. That which is perceived but once is speedily forgotten, because obliterated by subsequent associations. But if the idea recurs at intervals—not too long—permanent associations are established. In the arrangement of our curricula in America we have largely disregarded these fundamental laws. Most studies are taken for comparatively brief periods and then give way to others, which in turn are glimpsed panoramically. In most European countries, Germany especially, the studies are so arranged that they are kept before the mind for long periods of time. This idea will be developed more fully in later chapters. The importance of sense perceptions and the means of securing them; the arrangement of subject-matter so as to accord with the laws of apperception; the relation of motor activities in the learning processes; the importance of vivid and accurate imagination; and the organization of elemental acquisitions into the highest thought-products, all have a definite bearing upon memory processes and their training. Their importance is so great that consideration will be given to those phases in separate chapters.

CHAPTER XVI

IMITATION IN RELATION TO EDUCATION

General Illustrations.—All are familiar with the term "imitation" as employed by the popular mind. When one person performs some action because he has observed the same action in others, he is said to imitate. A child observes his father whistling. The child puckers up his lips and tries to do just as his father did. A new girl comes to school. She seems to be a leader and forthwith, as if by contagion, the whole school begin to ape her walk, her speech, her dress, her peculiar pronunciations, her fashion of dressing the hair, in fact all her actions are simulated as nearly as possible. Both of these are well-recognized cases of imitation.

Language has an instinctive basis, but its particular form is wholly due to imitation. That we speak and gesture rather than howl, bark, or neigh, is a matter of instinct; that we speak English, French, or German, rather than Russian, Armenian, or Choctaw, is due to imitation. The English boy drops his h's where we should put them on, or tacks them on where we should suppress them, simply because he lives with others who do so. The New Englander says nevah, rivah, and Jarvar; the Englishman says dŏg, while a western American says dawg; the Englishman calls a young bovine a cälf, while the ranchman maintains that it is a călf. In one region of the United States every one says bucket; in another, pail. I carry a pocket-book, the New Englander a wallet. The city man goes to church, his country cousin goes to meeting. I attended Sabbath-school when a boy, my children go to Sunday-school. Whether one whistles a *tune*, a *tyune*, or a *tschune*, all depends upon who his neighbors are. Slang phrases, catchy expressions, or popular songs are caught

up by the special circle to which they appeal; they are dinned into everybody's ears, and finally resound from the lips of all who have been made listeners, willing or unwilling. How many of us have felt chagrined on catching ourselves humming some meaningless nickeldom melody, or using the latest slang expressions? Just now we hear on every hand such phrases as "up to you," "up against it," "in the swim," "get busy," etc. Street urchins, loafers, business men, lawyers, doctors, and even preachers and teachers find these emphatic terms coming automatically to their tongues. College students in special sections and at different times have their own peculiar epithets and expressions. In one university, to study is to "dig," in another to "bone," in another to "buck," in another to "plug," in another to "plow." To recite poorly in one place is to "flunk," in another to "fall through"; to fail is to be "plucked." A good recitation sometimes "knocks the professor's eyes out," at others it "corks him," at others merely "squelches" or "strikes" him. In one university, to fail in examinations is to "bust!"

Manners and customs are products of imitation. Thousands of our every-day matters of etiquette no longer have any reason back of their performance. Though they may have originated in some rational way that has long since disappeared, they are now perpetuated solely through imitation. For example, the people of many nations shake one another's hands on meeting; but those from some countries shake their own hands. Americans and Englishmen say, "How do you do?" the German, "How goes it?" American men lift their hats to a lady; the German is more apt to do so on meeting a man. With Caucasians, black is an emblem of mourning; among Chinese, white performs the same service.

Fashions in dress are created and perpetuated through imitation. Were it not so, scores of hideous, unbecoming, unhygienic fashions could never have been launched. Desirable fashions are maintained in the same manner. There must be leaders who will be aped in all they do, to set the ball rolling. Their

devotees pay homage by immediate adoption. Metropolitan milliners, dressmakers, and tailors know that to insure changes of fashion all they need do is to induce some leader to appear in a new style, and the fashion is launched. This is a usual method of stimulating trade. Psychical laws are the most potent factors in economics. A history of furniture reveals characteristic styles prevailing often for centuries. But within the memory of every adult the styles in furniture have changed at least three distinct times. In dress, at least half a dozen special epochs may be traced through the last quarter-century, besides a semi-annual upheaval in minor matters. One should enjoy his Flemish oak and his Mission patterns as fully as possible to-day, for to-morrow they will be sought out by relic hunters. The sixteenth-century style was reopened to the sunlight for a day at the close of the nineteenth century, and shut away for another cycle to proclaim it the only style worth possessing.

Imitation Among Animals.—Cases of imitation among animals can also be recalled by all. The canary and the mocking-bird learn to sing from hearing others of their species; pointers and setters learn their peculiar feats largely from imitation. Monkeys make themselves appear at once intelligent and ludicrous through their powers of mimicry. Of course, many imitative acts are more easily learned than others, because they are also instinctive. Birds would learn to sing without hearing others of their species, but the kind of song depends upon what they hear for copy.

Non-Voluntary Imitation.—Imitation has usually been considered to be a voluntary act; *i. e.*, a conscious and purposive attempt to perform an act observed in another. Preyer, for example, maintains that the child is several months old before it really imitates. The majority of other writers have maintained similar views. But with this interpretation, where are we to place that large range of activities which play such an important rôle in what we call unconscious tuition? Unpurposively, subconsciously, I find myself doing as my associates do. I take

on tricks of speech, certain words and phrases and intonations; I find myself doing a thousand things my associates do; not because I intended to, but because the acts do themselves. The habits have me, rather than I the habits. We are all plagiarists without being thieves or criminals. Civilization is something each one borrows from his surroundings without ever returning it exactly to the owner. Now, why are we such unintentional copyists? An examination into the fundamental nature of imitation will undoubtedly render the matter clear.

Fundamental Meaning. Ideo-Motor Action.—An examination of certain psycho-physical relations will reveal that imitation is by no means confined to voluntary mental processes, but that it is one of the most fundamental phenomena of life. Recent researches have demonstrated that all thought is motor; that is, with the prevalence of any idea in the mind there is a tendency toward the motor representation of the elements composing that idea or of the symbols representing the idea. Suppose you are asked to think intently of a circle three feet in diameter on the ceiling. Those who think the hardest will raise the eyes slightly, and perhaps follow the contour of the circle with an unconscious rotary movement of the eyes. Suppose you open your mouth and think the word "bubble," "bottle," or any other word similar in method of pronunciation. The most noticeable phenomenon observed will be a distinct effort to allow the vocal organs to move in the accustomed way. So strong is this tendency that so-called mind-readers make use of it in deceiving the public. A person is asked to think hard of a word. Sound-reflectors are so arranged as to catch and magnify the sounds unconsciously produced through muscular vibrations. These are read by the shrewd impostor. Again, mind-reading, as evidenced by finding hidden articles, is simply muscle-reading. Table-turning, the planchette, the divining rod, and doubtless modern spiritism, can all be explained similarly.

Suppose you awaken some cold morning and say to yourself, "I must get up," but try to banish the thought and attempt to

take another nap. You continually find yourself thinking, "I must get up," "I must get up"; but you finally, apparently, banish the thought. All at once, when enjoying a cat-nap or a day-dream, without thinking, up you get. The thought has worked itself out into action. Any one can easily walk a two-inch board on the floor. But suppose the board is placed a hundred feet above the floor. No one but an acrobat or a trained gymnast could accomplish the feat without falling. Why the difference? In the latter case the thought of falling so possesses the mind as to inhibit everything else, and naturally enough the motor response speedily follows by destroying equilibrium and causing the fall.

All organic tissues possess the properties of irritability and contractility. Every nerve-cell is both sensory and motor. Consequently, whenever a sense-organ is stimulated, nervous tissues are affected, energy is liberated, and motor, *i. e.*, muscular, reactions tend to take place. This shows the basis of ideo-motor activities. It is a psycho-physical law that, whenever a sensation or a perception is received, some motor reaction must occur. If the idea is one that is understood or is familiar, the customary reaction occurs. In every-day life there are constant illustrations of this law. One is in company with another who speaks or otherwise acts in a striking manner. The particular action is copied unintentionally, and is at first probably set going only when in company with the copy. But by and by the process becomes so automatic and habitual that any stimulus may cause it to function. The given performance of any act, even an habitual one, is initiated through some suggesting factor. The suggestion may come from without or from within. At first the stimuli come from without, but later from within, and with sufficient force to initiate the process. Suppose it is a case of hearing slang or big words. They are absorbed, as it were. By and by the mere presence of the teacher of them produces an impulse to follow copy, and later, unless we guard against it, almost any impulse to expression is sufficient to suggest the other accompaniments.

Sensori-Motor Action.—The foregoing illustrations are of the ideo-motor-suggestion type. A persistent idea of an action was the suggestive force. In many cases of imitation the copy is not consciously apprehended at all. It may even come merely as a sensation and not rise to the dignity of perception. For example, some peculiarity is copied when it has never been consciously perceived in another. It has, however, made its impression and left its mark. Such cases are termed by Baldwin as of the sensori-motor-suggestion type, while those cases in which the stimulus is a clearly pictured idea are termed ideo-motor suggestions. The difference between the two types is, however, merely one of degree and not one of kind.[1] Undoubtedly, far more actions are copied because of sensori-motor or ideo-motor suggestion than in a purposive, conscious way. One's speech is largely acquired in those ways, as are nearly all those habits which go to make up one's manners and bearing. One who consorts with woodmen and miners takes on their manners, not because he has resolved to do so, but because of a law of life. The Chinaman's manners are those of China because of Chinese copy, and the Hindoo's because of East Indian copy.

Fundamentally, the simplest imitation is a phase of the process resulting from ideo-motor or sensori-motor suggestion. The stimulus starts a motor reaction, and in turn this motor reaction tends to reproduce the stimulus; then the motor process is again reinstated. As Baldwin puts it, "the essential thing, then, in imitation, over and above simple ideo-motor suggestion, is that *the stimulus starts a motor process which tends to reproduce the stimulus, and, through it, the motor process again.* From the physiological side we have a circular activity—sensor, motor; sensor, motor; and from the psychological side we have a similar circle—reality, image, movement; reality, image, movement, etc."[2] The only distinction to be made between imitation and sensori-motor suggestion is that in the imitative process each movement acts as a stimulus ringing up (using Baldwin's

[1] *Mental Development*, pp. 115–134. [2] *Op. cit.*, p. 133.

figure) the succeeding similar action. In sensori-motor suggestion the motor effect is the terminating link in the series. But if this link causes a repetition of the process it becomes imitation; that is, the first act is the *copy* which tends to perpetuate itself.

Imitation in Lower Organisms.—Although we usually ascribe imitation only to higher forms of animal life, it must become evident, from the study of sensori-motor action and ideo-motor action, that imitation may extend much lower down in the scale of intelligence. Baldwin has given us a very interesting and instructive discussion of the biological interpretation of imitation in which he makes imitation almost synonymous with organic adaptation and organic memory and ascribes it as a characteristic of all living matter.[1]

Baldwin maintains, and I subscribe to his doctrine, that we find evidence of the imitative, *i. e.*, self-sustaining, type of reaction in very simple organisms. He writes that "recent researches on the behavior of unicellular organisms and of plants show the same kind of so-called selective or 'nervous property,' with antithetic adaptations of attraction and repulsion. These creatures develop not by remaining still and awaiting the accidental repetition of stimulations by storming or assault. On the contrary, they do exactly what we have long thought it the exclusive right of higher conscious creatures to do; they go after, or shrink from, a stimulating influence, according as its former impression has been beneficial or damaging. In other words, they perform reactions of the stimulus-maintaining, or imitative type."[2]

These imitative or circular reactions, Baldwin believes, are manifested even by plants. Many complex plants manifest such perpetual movements as heliotropism, geotropism, and hydrotropism. He quotes the great botanist Pfeffer as saying "that irritability is never simply the result of the stimuli which bring out the reaction; these only serve to discover the properties and the specific agencies of the organism itself, and that the whole pro-

[1] *Op. cit.*, pp. 263–266.

[2] *Op. cit.*, pp. 272–273.

ceeding is due to the peculiar energy of the organism."[1] All bacteria seem to exhibit these circular reactive tendencies. When once stimulated by external agencies, they seem to perpetuate the same sort of reactions in obedience to some inner power—shall we say psychic? Engelmann says that "it cannot be denied that these facts point to psychical processes in the protoplasm."[2]

One step further and we have Verworn's theory that all protoplasmic activity is dependent upon the perpetuation of the activity once set going by an external stimulus. Kühne believes that fundamentally oxygen serves as the external stimulus to set the nervous protoplasmic machine going. "Kühne has proved," says Baldwin, "that the oxygen of the air has chemical affinity for the outer layer of particles of a protoplasmic mass. The elements set free by this union find themselves impelled toward the centre by their affinity for the nuclear elements. This new synthesis releases elements which again move outward toward the oxygen at the surface. Thus there are two contrary movements: away from the nucleus, or expansion, and toward the nucleus, or contraction. Considering the oxygen action as stimulus, we thus have a reaction which keeps up the action of its own stimulus, and thus perpetuates itself, giving just the type of reaction which my theory, outlined above, calls 'imitation.'"[3]

Auto-Imitation.—It has been necessary to consider in some detail the fundamental nature of imitation in its wider biological aspects in order to explain the involuntary imitation of man and other animals. Many of the involuntary imitations are repetitions of activities set up by the individual himself, *i. e.*, they are not imitations of some one else. They are auto-imitations. Oftentimes the initial factor is purely accidental. For example, the child strikes a resounding surface with something in his hand. It gives forth a noise which pleases him; he repeats the act, and the series of circular reactions—muscular activity; sound, muscular activity—is kept up until fatigue or exhaustion occurs. The fatigue may be in the arm muscles or in the ear. The point

[1] *Op. cit.*, p. 275. [2] *Op. cit.*, p. 273. [3] *Op. cit.*, p. 272.

is, some nerve-cells have become exhausted sufficiently to inhibit the further working of the circular machinery. Again, the child accidentally makes some sound, as *mä, mä*. It pleases him and he continues in an apparently unthinking and mechanical way. I have noticed a child during the period from the sixth to the seventeenth month produce many of these repetitive babblings. A syllable such as *bä, bä; dă, dă; gä, gä;* or *nin, nin,* hit upon either out of overflowing pleasure or begun as a half-whining discord, has been repeated by the quarter hour. When about ten months old, my boy accidentally got hold of his own tongue. The sensation received was sufficient stimulus to cause him to keep up the examination process for a long time. Much earlier, he found his toes and other parts of the body in the same way. The same stimulus always provoked a similar reaction.

Importance of Non-Purposive Imitation.—The above represents the typical genesis of a large part of the child's accomplishments. He learns to talk in this way, for his first words are not imitations of his elders; his elders imitate him. He hits upon new ways of sound-producing, new ways of locomotion, new ways of manipulating his hands, new ways of building, new ways of commanding his elders, new ways of sampling things, and through the pleasurable reaction he unreflectingly, almost reflexly, continues the pleasurable process. "Professor Preyer's child was so delighted with the discovery that it could put a cover on a box, that it deliberately took it off and replaced it seventy-nine times without an interval of rest. It was an educative step in its development—a step in the discovery of its selfhood as an energy, as well as a step in the discovery of adaptation in the external world."[1] It has been argued that the child even imitates pain-bringing processes, but can it not be said that there is a pleasure—satisfied curiosity, accomplishment of end, or something of the sort that serves as a pleasure, to overbalance the pain? Sometimes adults irritate a wound or a swelling, producing great pain, but over and above the pain is exquisite pleasure.

[1] Harris, *Psychologic Foundations of Education*, p. 296.

Are not many of the automatisms of adult life phases of the non-conscious imitations of the sensori-motor and ideo-motor types? We are continually imitating things unintentionally. We of a given section of the country remove to another section, and ere we are aware begin to change our pronunciation. We have not intended to do so; we have scouted the idea, even ridiculed the custom, but here we are following suit. Who has not found an accretion of slang adhering to his vocabulary after being subjected to hearing it for some time? Who has not found himself unintentionally gesturing, or walking, or conducting himself, like some one in whose company he has recently been? I have found myself on the lecture platform assuming positions, tones of voice, general bearing—rather lamely—but nevertheless simulating a certain speaker. I had not intended to, but his style had so integrated itself into my lecture ideals that here it was working itself out in motor consequents. The explanation above on the basis of sensori-motor relationships must be extended to include ideo-motor sequences. When we shall have become appreciative of the wonderful and absolutely certain results of ideo-motor action, we shall be much more solicitous to have the mind constantly supplied with a stock of desirable ideas, resting assured that righteous action will follow as a consequent upon righteous thinking and desiring.

Beginnings of Voluntary Imitation.—It is impossible to indicate any absolute time when imitations first make their appearance. Instinctive imitations of various kinds manifest themselves almost from birth in the lower animals. Intelligent imitations are usually ascribed to man, but undoubtedly many of the imitations of lower animals are as clearly intelligent as those undesigned ones of man. The dog that does just what another dog did in order to be petted or fed, is imitating, and doing the act with an end in view, and as he has observed it in others.

Darwin thought his boy imitated sounds at four months, but was not positive of any imitation until the sixth month. Preyer records observing his child imitate pursing his lips in the fif-

teenth week. But it is doubtful if these are cases of deliberate imitation, or even imitation at all. Tiedemann believes his son made imitative movements with his mouth when he saw any one drinking. In the fourth month a child has been noticed trying to cough in imitation of his own accidental coughing. Preyer observed his boy fifteen months old trying to blow out a candle-light as he had seen others do. I have seen my child of six months try to cover his face with a handkerchief to play peek-a-boo as I had done. I covered my face and he also tried to put the handkerchief over my face. Repeatedly I have seen him strike the table after seeing me drum on it in trying to produce a noise for his amusement. At ten months he deliberately hid behind a bench and occasionally peeked out to laugh and be laughed at. We had not done this identical thing, but was he not imitating? At nine months he tried to put a spoon in his mouth as he had seen others do. At the same age, after pulling my hat off, he tried to put it on my head as I did.

Tracy says that as early as the third and fourth months the "buddings of the imitative propensity" may be observed. "Raw attempts at vocal imitation may be observed even in the second month, when the child makes a response to words addressed to him. This, however, is mechanical. In the third month the child will imitate looks, *i. e.*, he will look at an object at which others are looking."[1] I have never observed anything of this until about the sixth month, and it is doubtful whether this is an imitative act, even though volitional.

Champneys says his child tried to imitate sounds of talking in the thirteenth week. "A boy of seven months tried hard to say simple monosyllables after his mother. Another is reported to have accomplished his first unmistakable imitations when seven months old, in movements of the head and lips, laughing, and the like. Crying was imitated in the ninth month, and in the tenth imitation of all sorts was quite correctly executed, though even at the end of the first year new movements, and those requiring complex co-ordination, often failed. A

[1] *Psychology of Childhood*, p. 104.

child of eight and a half months, having seen the mother poke the fire, afterwards crept to the hearth, seized the poker, thrust it into the ash-pan, and poked it back and forth with great glee, chuckling to himself. Another child, in his tenth month, imitated whistling, and later, the motions accompanying the familiar 'pat-a-cake,' etc. In his eleventh month he used to hold up the newspaper and mumble in imitation of reading. Another boy, in his eleventh month, used to cough and sniff like his grandfather, and amused himself by grunting, crowing, gobbling and barking in imitation of the domestic animals and birds. A little girl of this age used to reproduce with her doll some of her own experiences, such as giving it a bath, punishing it, kissing it, and singing it to sleep."[1]

Dramatic Imitation.—One of the important elements of dramatic representation is the imitative. Through suggestion an idea is received and its representation is carried out with more or less fidelity. In children the impersonated self often becomes so real as temporarily to supplant the usual self. James writes:[2] "For a few months in one of my children's third year he literally hardly ever appeared in his own person. It was always 'Play I'm So-and-so, and you are So-and-so, and the chair is such a thing, and then we'll do this or that.' If you called him by his name, H., you invariably got the reply, 'I'm not H., I'm a hyena, or a horse-car,' or whatever the feigned object might be. He outwore the impulse after a time; but while it lasted, it had every appearance of being the automatic result of ideas, often suggested by perceptions, working out irresistible motor effects." Sully tells us that children, when pretending to live another life, frequently resent any intrusion that seems to contradict the harmony of the simulated world. He relates that "a little girl of four was playing 'shop' with her younger sister. 'The elder one,' (writes the mother) 'was shopman at the time I came into her room and kissed her. She broke out into piteous sobs. I could not understand why. At

[1] Tracy, *op. cit.*, p. 104.
[2] *Principles of Psychology*, II, p. 409.

last she sobbed out: "Mother, you never kiss the man in the shop." I had with my kiss quite spoilt her illusion.'"[1]

Imitation Is Not Servility.—Imitativeness has been popularly supposed to be a mark of servility; a characteristic only of those who are immature or mentally deficient. But in the light of recent investigation it has received new interpretation. Instead of being confined to certain animals, children, and abnormal adults, it is found to be a most fundamental law of psychophysical action. All animals, from the lowest to the highest forms, are imitative. Many animal-trainers exclude all animals that do not show some aptness at imitating. Only those that show some imitative tendency can be successfully trained. Children who do not imitate readily are always dull. We are wholly justified in saying that the more imitative the individual, the more educable.

Imitation in Social Life.—Imitation is so common that we scarcely think of its exceeding potency in the development of individual and social life. Most psychologists, even, have passed it by with scarce honorable mention. But when we have analyzed it and found how intimately it is interwoven with nearly every other psychic function, we do not doubt its importance. When we attempt to merely catalogue the various ways in which it is manifested, we realize the impossibility of doing the subject justice. Professor Royce writes: "Were I anxious, then, for mere illustrations of the frequency of the imitative functions in the life of man, I should indeed have no trouble in getting my fill of them, without other aid than that of my own eyes." In fact, we may rightly conclude that our whole social fabric and moral practices are largely determined by imitation.

For example, imitation is rife in politics. The majority of men vote the party ticket of their fathers. Few come to fixed, independent beliefs through reflection and deliberation. Men often believe themselves original thinkers, but even college-bred men vote largely as their fathers did. Deahl made an investigation which, though in a somewhat limited field, confirms

[1] *Children's Ways*, p. 23.

casual observations. He found that out of fifty men selected from among college graduates, and many of them college professors, eighty-four per cent. voted the same ticket as their fathers voted.[1] Could a promiscuous canvass of the less well educated be secured, the percentage would probably be even larger.

Commercial panics are good examples of the force of wholesale imitation. Let it be rumored that there is a run on the bank. If a neighbor is known to have withdrawn deposits, a dozen will follow his example, and immediately a stampede is precipitated. At a fire, one giddy, emotional individual can cause the multitude to indulge in a mad, frenzied rush, while a calm, phlegmatic temperament assuming generalship can quiet the turbulence and lead the unstable throng to safety. Because of suggestibility and imitation we have such phenomena as the religious crazes of the Middle Ages, mediæval mental epidemics, witchcraft, demonophobia, the Dutch tulip craze, and the Mississippi scheme. In the presence of a crowd the suggestibility of each individual is heightened, and the tendency to imitate rash actions is much greater. Sidis says: "Men think in crowds, and go mad in herds."[2] James says this impulsive tendency to act in crowds as soon as a certain perception occurs is instinctive in man and other gregarious animals. Leadership, except when accompanied by perfect sanity, is apt at some time to lead multitudes to disaster. The Crusades serve as a good example of what I mean. Tarde writes: "In general, a naturally prestigeful man will stimulate thousands of people to copy him in every particular, even in that of his prestige, thereby enabling them to influence, in turn, millions of inferior men."[3]

Royce says that "among children and among adults virtue and vice alike are, under favorable circumstances, 'catching'; that fashion has, in certain matters, an irresistible sway; that not only commercial panics, and mobs, and 'fads,' but also great reform movements, and disciplined armies, and such historical

[1] *Imitation in Education*, p. 25.
[2] *Psychology of Suggestion*, p. 343.
[3] *Laws of Imitation*, p. 84.

events as the conversion of nations in the old days from heathenism to Christianity, all illustrate, in their several ways, the potency of imitative tendencies; and that art itself, at least according to Aristotle's famous definition, is essentially imitation. We know that there are sometimes epidemics of crime or of suicide. We know that the doleful prevalence of the current popular melody is due, not to a love of music, but to the insistent force of the imitative tendency. Turn, thus, which way we will, the familiar presence of the imitative functions in human life impresses itself upon us." [1]

In emphasizing the unconscious power of imitation, Royce cites Tarde, who "asserted and developed the interesting formula that what the individual hypnotizer is to his sleeping and abnormally plastic subject, such, almost precisely, is society to the waking and normally plastic man." Tarde has somewhere said in effect that "society is imitation, and imitation is a kind of somnambulism." The laws of imitation are precisely the same laws of psycho-physical action that govern hypnotism. In the hypnotic state the ordinary inhibitions of normal waking life are removed. The hypnotist then monopolizes the attention with ideas of whatever he wishes to have the subject execute. Then, because of the laws of ideo-motor action, the results follow as a matter of course. The teacher would perhaps better not proclaim hypnotic laws as one of his usual methods of securing obedience, but the psychologist recognizes that the successful teacher utilizes exactly the same fundamental laws as does the hypnotist.

Dr. Harris writes:[2] "The place of imitation in the development of civilized man is beginning to be recognized. Not only does imitation give rise to language, but it leads to the formation of institutions, the family, civil community, the state, the church—those greater selves which re-enforce the little selves of isolated individuals. Imitation is social in its very nature, for it is the repetition by the individual within himself of the

[1] *Century Magazine*, 48: 138.
[2] *Psychologic Foundations of Education*, p. 299.

deeds of his fellows. . . . The individual man repeats for himself the thinking and doing and feeling of his fellows, and thus enriches his own life by adding to it the lives of others. Thus . . . his own life becomes vicarious for others, and he participates vicariously in the life of society. The psychology of imitation explains the mode in which the individual unites with his fellow-men to form a social whole."

He further writes:[1] "Thus we see that there is an element of originality in the most mechanical phase of imitation. The self is active and assimilative. It sees an external deed which it proceeds to make its own deed by imitation. The child proves itself to possess a human nature identical with the one whom it imitates. Originality grows by progressive deepening of the insight into the causes and motives of the thing imitated. The lowest stage of imitation superstititiously imitates all the details, because it has no insight into the grounds and purposes of the action imitated, and but little comprehension of the means employed. When it understands the means and the motives, it strikes out for itself and makes new adaptations. It modifies its imitations to suit differences of circumstances. Originality grows with this ascending comprehension of means and purposes. There comes a time when the imitative child comprehends the principle as well as does the master whom he imitates, and then he is emancipated from all imitation in this part of his education. If he keeps on and comprehends the genesis of the principle from deeper principles, he emancipates himself from even the 'hypnotic suggestion' of the principle itself, and all external authority has become inward freedom."

Imitation in the Fine Arts.—Although the products of the fine arts are not mere copies, they are, nevertheless, imitative. Sir Joshua Reynolds says: "Our art is not a divine gift, neither is it a mechanical trade." Even though an artist does not copy other works of art, he must go to nature for her innumerable forms. Goethe writes: "The artist must hold to nature, imitate

[1] *Psychologic Foundations of Education*, p. 302.

her. He must choose the best out of the good before him." Art has gradually developed by slowly accumulating imitative accretions. Visit the famous art galleries and study the art of schools or periods. To the novice the sameness in a given school or period is more striking than the differences. The individual variations which the connoisseur recognizes as originality and marks of genius are very real and very great to the critical eye, but they are apt to be overlooked by the multitude.

Deahl writes: "The fundamental principle in any school of art or of literature is imitation. Among the master artists it is selective, intelligent, often unconscious imitation. Among the second or third rate artists imitation is the cause of the similarity, but is a less intelligent, a more mechanical kind of imitation; it approaches nearer to what we term copying."[1] Before the artist exhibits great originality he must spend years in imitating—either nature or the products of other artists. This in no wise implies mere copying. It means that the great works should be studied, the principles mastered, the ideals absorbed, and new inspiration developed out of them. It is said that William M. Hunt, one of America's eminent artists, advised continued study of the best works of art. "You must set yourself ahead by studying fine things. I've told you over and over again whose works to draw—Michael Angelo, Raphael, Dürer, Holbein, Mantegna. Get hold of something of theirs. Hang it up in your room, trace it, copy it, draw it from memory over and over, until you own it as you own 'Casabianca' and 'Mary had a Little Lamb.'"[2]

Imitation in Literature.—Although imitations are not so easily traceable in literary productions, yet a critical study of many of the masterpieces will disclose the effects of suggestion, at least. Longfellow's "Hiawatha," as is well known, has a prototype in the Finnish poem, "Kalevala." Longfellow cannot be said to have copied from "Kalevala," but he received very

[1] *Imitation in Education*, p. 31.
[2] Quoted by Deahl, *op. cit.*, p. 29.

definite suggestions as to both the form and the content. Chaucer was doubtless much indebted to Boccaccio for suggestions which were utilized in *The Canterbury Tales.* Most of Shakespeare's plots were not absolutely original with him. Carlyle's *Sartor Resartus* is plainly of German origin. Rabelais, while imitating the Greeks, afforded suggestions for many who followed him. Many incidents similiar to those in *Don Quixote, Robinson Crusoe,* and *Gulliver's Travels* under other names and bearing the imprint of other pens are said to have delighted many, even centuries ago. To assert these facts is in no wise to discredit the authors. To be able to imitate and give in addition the creative touch of a new whole is evidence of genius. The majority either copy blindly and poorly without deviation or advance, or they do not see what is worth while to imitate. Without making use of what has been wrought and giving it a new turn, the world would remain at a standstill. To imitate is no sign of weakness. "When a writer improves what he imitates, he does well; but when he fails to add beauty, we condemn him. New light, or grace, or charm must be given. In the progress of the mind, in all departments of literature, we find imitation, the most palpable in the books we most admire."[1]

Educational Value of Imitation—General.—Although mere ability to copy, without discrimination in selecting copy and without judgment in making use of what is copied, is not a high accomplishment, yet the instinct and the capacity to imitate furnish the starting-point for all improvement. Otherwise, of what use would experience be? Professor Royce says that "only the imitative animal can become rational." As we begin to understand its nature and its possibilities better, we shall make more definite attempts to utilize imitation in education. It is at once evident that a force so potent in shaping thought and action, whether we will or no, should be considered in the purposive regulation of thought and conduct. If, through ideomotor action and imitation, we necessarily appropriate our

[1] Deahl, *op. cit.*, p. 33.

environment and become modified in consonance with it, we are plainly admonished to shape environment so as to contribute best toward the ideal results desired. If we must imitate, the great educational question is how to select wisely copy that is worthy of imitation.

Every teacher ought to understand the great importance of imitation. Up to the time the child has entered school, a very large proportion of its knowledge has been gained and retained in a purely imitative way. Several of the ancient writers on education realized the importance of imitation in education. Plato shows its value in learning language, music, painting, science, dancing, literary style, and also in the formation of character. Xenophon believed that the most effective way of teaching behavior and manners is through imitation. Aristotle cautions against leaving children much with slaves, and also urges us to be careful what stories children hear. Many Greeks are known to have been solicitous that their children should mingle with those only who spoke pure Greek. Plutarch urged in his essay on *The Training of Children* that they should be shielded "lest, being constantly used to converse with persons of a barbarous language and evil manners, they receive corrupt tinctures from them. For it is a true proverb, 'that if you live with a lame man you will learn to halt.'" Quintilian would insist that the nurse have a good moral character, and that she should "also speak with propriety. Let the child not be accustomed, therefore, even while he is yet an infant, to phraseology which must be unlearned." Walt Whitman writes:

> "There was a child went forth every day,
> And the first object he looked upon, that object he became,
> And that object became part of him for the day, or a certain part of the day,
> Or for years or stretching cycles of years.
> The early lilacs became part of this child."

Another poet wrote:

> "This price the gods exact for song,—
> That we become what we sing."

From Walter Pater we have the following words apropos of the subject:

"Imitation: it enters into the very fastnesses of character; and we, our souls, ourselves, are forever imitating what we see and hear, the forms, the sounds which haunt our memories, our imagination. We imitate not only if we play a part on the stage, but when we sit as spectators, while our thoughts follow the acting of another, when we read Homer and put ourselves lightly, fluently, into the place of those he describes: we imitate unconsciously the line and color of the walls around us, the trees by the wayside, the animals we pet or make use of, the very dress we wear. Men, children are susceptible beings, in great measure conditioned by the mere look of their 'medium.' Like those insects, we might fancy, of which naturalists tell us, taking color from the plants they lodge on, they will come to match with much servility the aspects of the world about them." [1]

Imitation in Language Education.—Think what it means to learn to talk! A grown person would give a great deal to learn to speak a foreign language correctly in a few years. The child at five or six years has gained almost perfect command of the oral expression of all his thoughts. Of course, his ideas and his vocabulary are limited, but his expression is almost perfect within his limited range. At this age the number of words is not so small, either, as one might suppose. An average child of six years, brought up in a good home, possesses a usable vocabulary of a couple of thousand words. He understands nearly double that many. An adult often spends years of painfully conscious labor in acquiring the vocabulary of a foreign language. Not only does imitation determine the tongue which the child is to speak, but the vocabulary, the inflection, to some extent the tone, the rapidity of speech, order of words, and choice of illustrations, are also all matters of imitation.

It is easy to recognize the rôle played by imitation in the first years of childish attempts to master the mother tongue. Children learn through imitation to clip their words, to intone them

[1] *Plato and Platonism*, p. 245.

clearly, to talk in monosyllables, or to drawl. The boy when asked why he drawled his words replied, "Mother drawls her'n." The deaf child, unable to imitate the speech of his fellows, remains mute (unless he learns lip or throat reading). The child who lives in a home where correct language is spoken, and who hears good language among his playmates, will speak correctly, barring a few inaccuracies resulting from irregularities in the structure of the language. He will learn to syllabicate properly, utter words distinctly, and to give correct emphasis to his expressions. The teaching of language in schools is often rendered difficult because children have so much to unlearn. Years of imitation of undesirable models counteract the efforts in the right direction. Chubb in his admirable work, *The Teaching of English*, has some very valuable words concerning imitation. He says we shall be less prone to exhaust the child by this effort to "draw him out, and get him to overhaul and dissect and play the showman to his possessions, if we bear in mind more constantly the nature of the assimilative process; so that we may assist rather than retard it. The prehensile power of the child is not so much rational and analytic, as imaginative and imitative. The way to get him to appropriate a fact or idea is not to labor with him until he knows that he knows, but to insure some sort of unconscious imitative reaction. He must unconsciously *do* something about it. . . . We conclude that everything he sees and hears evokes a motor responsiveness in him; it comes loaded with motor suggestion and starts a process of motor reaction, a process that education may either inhibit or encourage. It is not necessary, however, that he should actually re-enact the story he has heard, that he should *physically* do something about it; he may react imaginatively."[1]

Roger Ascham insists that "All languages, both learned and mother tongue, be gotten, and gotten onlie by imitation. For as ye vse to heare, so ye learne to speake: if ye heare no other, ye speake not your selfe; and whome ye onlie heare, of them you onlie learne. . . . And, therefore, if ye would

[1] Chubb, *The Teaching of English*, p. 31.

speake as the best and wisest do, ye must be conversant, where the best and wisest are: but if you be borne or brought up in a rude countrie, ye shall not chose but speake rudelie: the rudest man of all knoweth this to be trewe." [1]

In all language acquisition of the child, the most important factor is imitation—at first unstudied and purely absorptive, and gradually becoming conscious and purposive. At first the all-important thing is to have the child hear only the purest of speech. He will then re-echo exactly as he has heard. Later he should not only hear pure speech, but he should become saturated with the forms of the choicest diction expressed in literature. Gradually the beauty of forms of expression in literature should be brought to his consciousness in order that he may rise from the stage of reflex imitation to the higher, studied idealistic stage. The primary consideration, however, is to so pre-empt the mind with the choicest form and content in literature that spontaneous expression of a similar nature will follow necessarily as a result of the laws of ideo-motor action.

Properly guarded, even definitely studied imitative reproduction of the best models is of great assistance in acquiring ideal habits of expression. Occasionally, when a pupil has read a piece of literature, it is well to have him reproduce it with all the imitativeness he can command. For what other purpose has he studied than to make the thought and the art his own? So long as the art has become integrated into his own style and is not a borrowed garment put on for the occasion, there is no danger. A careful distinction must, of course, be kept in mind between proper imitation and mere copying. Spontaneity and naturalness are prime desiderata, and are not sacrificed if the language work is made a matter of assimilation and not one of mechanical memory. The models for studied imitation should also be varied, and none long continued.

The place and meaning of imitation which are here desired to be emphasized are well illustrated in many of the present-day books on composition, in which the basis of composition work is

[1] *The Schoolemaster.*

to be the study of the choicest literary models of the various forms of composition. The relation between composition and literature is well set forth by Principal Webster in the preface to his book on teaching composition through the study of models. He says:

"There are two classes of artists: geniuses and men of talent. Of geniuses in literature, one can count the names on his fingers; most authors are simply men of talent. Talent learns to do by doing, and by observing how others have done. When Brunelleschi left Rome for Florence, he had closely observed and had drawn every arch of the stupendous architecture in that ancient city; and so he was adjudged by his fellow citizens to be the only man competent to lift the dome of their Duomo. His observation discovered the secret of Rome's architectural grandeur; and it is the accumulation of such secrets which is the development of every art and science. Milton had his method of writing prose, Macaulay his, and Arnold his—all different and all excellent. And just as the architect stands before the cathedrals of Cologne, Milan, and Salisbury to learn the secret of each; as the painter searches out the secret of Raphael, Murillo, and Rembrandt; so the author analyzes the masterpieces of literature to discover the secret of Irving, of Eliot, and of Burke. Not that an author is to be a servile imitator of any man's manner; but that, having knowledge of all the secrets of composition, he shall so be enabled to set forth for others his own thought in all the beauty and perfection in which he himself conceives it." [1]

Chubb says: "Children learn their native tongue by imitation; and imitation continues to be, throughout the school course, the chief factor in language work. The rules of grammar and rhetorical precept are later and comparatively unimportant means to the end sought. Of models, the most influential is the teacher herself; the influence of book models is heavily discounted if the teacher's own practice is not exemplary and winning. And by example we mean, first and foremost, oral example." [2]

[1] *English Composition and Literature*, p. ix. Another book illustrating the same plan is that of Kavana and Beatty, *Composition and Rhetoric.*

[2] *The Teaching of English*, p. 374.

He further says: "Children learn to write as they learn to swim—by watching and imitating others; by trying under the lead of a model. They develop a feeling and instinct and knack for writing, without which they will never be effective as writers. . . . The child or youth who writes well is he who feels that he has something to say, wants to say it, and to say it well—to make his point. He naturally falls back, consciously or unconsciously, upon examples known to him." [1]

The testimony of some really successful writers concerning their method of learning to write should be valuable. Stevenson writes of imitation in this connection: "That, like it or not, is the way to learn to write. It was so Keats learned, and there never was a finer temperament for literature than Keats's; it is so, if we could trace it out, that all men have learned. Perhaps I hear some one cry out: 'But that is not the way to be original!' It is not; nor is there any way but to be born so. Nor yet, if you are born original, is there anything in this training that shall clip the wings of your originality. There can be no one more original than Montaigne, neither could any be more unlike Cicero; yet no craftsman can fail to see how much the one in his time tried to imitate the other. Burns is the very type of a prime force in letters; he was of all men the most imitative. Shakespeare himself, the imperial, proceeds directly from a school. Nor is there anything here that should astonish the considerate. Before he can tell what cadences he truly prefers, the student should have tried all that are possible; before he can choose and preserve a fitting key of words, he should long have practiced the literary scales . . . and it is the great point of these imitations that there still shines beyond the student's reach his inimitable model."

Stevenson further says: "Whenever I read a book or passage that particularly pleased me, I must sit down at once and set myself to imitate that quality of propriety or conspicuous force or happy distinction in style. I was unsuccessful and I knew it, but I got some practice in these vain bouts in rhythm, in

[1] *Op. cit.*, p. 382.

harmony, in construction, and in co-ordination of parts. I have thus played the sedulous ape to Hazlitt, to Lamb, to Wordsworth, to Browne, to Defoe, to Hawthorne, to Montaigne, to Baudelaire, and to Obermann." [1]

Franklin's early reading gave him a bias toward dogmatic disputation. This was later overcome by imitation of a different style. He found himself lacking "in elegance of expression, in method, and in perspicuity." He then came across a volume of the *Spectator*, of which he says, "I read it over and over and was much delighted with it. I thought the writing was excellent, and wished, if possible, to imitate it. With that view I took some of the papers, and making short hints of the sentiments in each sentence, laid them by a few days, and then, without looking at the work, tried to complete the papers again, by expressing each hinted sentiment at length, and as fully as it had been expressed before, in any suitable words that should occur to me. Then I compared my 'Spectator' with the original, discovered some of my faults, and corrected them." To acquire a stock of words and a readiness in recollection and use of them, he "took some of the tales in the 'Spectator' and turned them into verse; and after a time when I had pretty well forgotten the prose, turned them back again."

Imitation in Developing Personality.—The teacher needs to observe carefully the effects of varying impressions upon the class. Warner tells us[2] that "the sight of your movement brings into activity the same combination of nerve-centres as you use. This is one means by which you determine action in the child's brain." Because children are such imitators of one another they are unconsciously securing some sort of education. Care must be exercised to exclude undesirable companions, those with either physical, mental, or moral defects. Cases are numerous in which those afflicted with diseases such as St. Vitus' dance (chorea) have caused others to become afflicted solely through imitation. Stammering, hysterics, and even ordinary fright

[1] Stevenson, *Memories and Portraits*, p. 55.
[2] *Mental Faculty*, p. 89.

become epidemic. Children possessing tendencies toward excitability and over-mobility should be with children having good self-control. By imitation of these latter the pathological tendencies may disappear. Yawning, gaping, coughing, restlessness, may become infectious in a class. Every word, gesture, peculiarity of walk, facial expression, intonation of voice, is certain to be absorbed and unconsciously or purposely represented in action. Thus, habits of language become universalized in a school or community, a certain type of manner becomes typical of a school, certain methods of study and recitation often characterize a system of schools. In one place recitations are clear-cut, intelligently rendered, while in another school they are always disconnected, mumbled, and indistinct, and rendered with no apparent pride. Even an excellent teacher cannot model things to his own liking if the custom does not sanction his way. A splendid teacher once failed in a country school because he insisted on having the boys remove their hats during recess while in the school-room. Each one was simply imitating a prevailing custom, and they rebelled against any deviation. Put the most obstinate of those boys in a school where custom dictated baring the head indoors and see how quickly he would uncover, with never a word of opposition.

Thus through imitation the child is to absorb many of the most valuable lessons of life. All the elements that go to make up what we term "bearing" or "personality" are largely products of imitation. To a large extent one's character is determined imitatively by the company one keeps. It is frequently true that ideals of life and conduct are imitative reflections more than particular intellectual acquisitions. Feelings are especially contagious. Attitudes toward life and its various problems are taken on through inoculation when the reasons therefor are not at all apparent. As nearly all the world's great wrong-doings, resulting in robbery, embezzlement, drunkenness, poverty, pauperism, vice, divorce, murder, suicide, etc., result from a distorted view of life, duty, and happiness, it becomes highly important to radiate ideals which shall counteract the distorted ones.

Münsterberg, in speaking of the moral aspect of suggestion, says: "We have no mystic power by which our will simply takes hold of the other man's will, but we inhibit and suppress by influence on the imagination those abnormal impulses which resist the sound desires. If that were immoral, we should have to make up our minds that all education and training were perverted with such immoral elements. Every sound respect for authority which makes a child willing to accept the advice and maxims of his elders is just such an influence. If it were really a moral demand that the will be left to its own resources, and that no outside influence come to strengthen its power or remove its hindrances or smooth its path, then we ought to let the children grow up as nature created them, and ought not to try to suppress from without by discipline and training, by love and encouragement, the wilful impulses and the ugly habits. Even every good model for imitation is such a suggestive influence from without, and every solemn appeal to loyalty and friendship, to patriotism and religion, increases the degree of suggestibility. It is the glory of life that the suggestive power may belong to moral values instead of mere pleasures, but it is not the aim of life to remain untouched by suggestion. And he who by suggestion helps the weak mind to overcome obstacles which the strong mind can overthrow from its inborn resources, works for the good of the individual and of the community in the spirit of truest morality."[1]

Imitation in Adolescence.—At no period of life is imitation more slavish than during adolescence. While children imitate much without reflection, yet they care little for public opinion and imitate little merely to receive personal approval. But the adolescent is so completely absorbed in securing approval of those whose opinion he courts that he is as absolutely enslaved as if indentured or hypnotized. His idealization amounts to apotheosis, and he is blind and deaf to all else. Popular sentiment rightfully cried out against the fagging system in the great public schools of England, but it was not because the fags

[1] Münsterberg, *Psychotherapy*, p. 378.

wailed or bemoaned their hard lot. They doubtless considered their menial tasks not as degrading, but on the contrary as the highest honor. What boy has not run chasing the ball for the big fellows until ready to drop from exhaustion? How many boys have not been beguiled by some unscrupulous, though, to them, fascinating bully into doing things which would horrify their parents, and later themselves, simply to meet the approval of their hero? Fagging at Rugby was censured because of the debasing effects of this early slavery of the will, which blighted the life of many a youth who was too frail-willed to outgrow the temporary hypnosis.

College government largely depends upon the public sentiment espoused by the students themselves. Faculty rules are insignificant in comparison with the laws enunciated by the leaders of the classes. High-school pupils, though not so assertive, idealize and idolize even more blindly. What is more suggestive of the cataleptic trance than the high-school boy in love, especially with some one old enough to be his mother? Were youth not purblind in their hero-worship, what boy would repeat the deathly sickness of his first smoke simply to project himself into his ideal world? What college freshman would don a fools-cap, a dress-suit, or a clown's garb and labor six hours rolling a peanut through the main street of the town, or do the thousand and one other equally inane things so lacking in fun for adults that even the street laborers will not turn their heads to look? We should not bewail such actions nor pronounce censure, but we should understand the mental attitude and be sympathetic. These are perfectly normal phases of development, peculiar to those ages, and will be moulted in due time.

Because of this blind and excessive fidelity to a course of life once assumed, it behooves the guardian of youth to provide desirable copy for the youth to imitate. Many a youth's aim has been low through life simply because he has too early idolized unworthy copy. It is highly important that boys and girls both see something of the world outside their own circumscribed community before developing too fixedly their ideals of

life work, and especially of life companions. Savonarola was saved to the world for a monumental work because the ignorant shepherdess rejected his suit when he was a callow youth. His wanderings caused by his fancied dejection gave him an enlarged horizon and higher ideals.

Baldwin has emphasized the necessity of varied copy, saying: "Observers should report with especial care all cases of unusually close relationship between children in youth, such as childish favoritism, 'platonic friendships,' 'chumming,' in school or home, etc. We have in these facts—and there is a very great variety of them—an exaggeration of the social or imitative tendency, a narrowing down of the personal suggestive sensibility to a peculiar line of well-formed influences. It has never been studied by writers either on the genesis of social emotion or on the practice of education. To be sure, teachers are alive to the pros and cons of allowing children and students to room together; but it is with a view to the possibility of direct immoral or unwholesome contagion. This danger is certainly real; but we, as psychological observers, and above all as teachers and leaders, of our children, must go even deeper than that. Consider, for example, the possible influence of a school chum and roommate upon a girl in her teens; for this is only an evident case of what all isolated children are subject to. A sensitive nature, a girl whose very life is a branch of a social tree, is placed in a new environment, to engraft upon the members of her mutilated self—her very personality; it is nothing less than that—utterly new channels of supply. The only safety possible, the only way to conserve the lessons of her past, apart from the veriest chance, and to add to the structure of her present character, lies in securing for her the greatest possible variety of social influences. Instead of this she meets, eats, walks, talks, lies down at night, and rises in the morning, with one other person, a 'copy' set before her, as immature in all likelihood as herself, or, if not so, yet a single personality, put there to wrap around her growing self the confining cords of unassimilated and foreign habit. Above all things, fathers, mothers, teachers, elders, give the

children room! They need all that they can get, and their personalities will grow to fill it. Give them plenty of companions, fill their lives with variety—variety is the soul of originality, and its only source of supply. The ethical life itself, the boy's, the girl's conscience, is born in the stress of the conflicts of suggestion, born right out of his imitative hesitations; and just this is the analogy which he must assimilate and depend upon in his own conflicts for self-control and social continence. So impressively true is this from the human point of view, that in my opinion—formed, it is true, from the very few data accessible on such points, still a positive opinion—children should never be allowed, after infancy, to room regularly together; special friendships of a close, exclusive kind should be discouraged or broken up, except when under the immediate eye of the wise parent or guardian; and even when allowed, these relationships should, in all cases, be used to entrain the sympathetic and moral sentiments into a wider field of social exercise."[1]

Imitation in School Government.—It has been said that as is the teacher so is the school, and no doubt Channing was right when he said that "a boy compelled for six hours a day to see the countenance and hear the voice of a fretful, unkind, hard or passionate man is placed in a school of vice." But I am inclined to think we overrate the teacher's influence, and underrate the influence of pupil companions. A study of what children imitate most has revealed to me that children imitate other children, usually those slightly older than themselves, more than they do adults. Let a few children become interested in some new game or play and it usually spreads all over a city. From time to time there are epidemics of playing marbles, tops, circus, jack-o'-lanterns, foot-ball, base-ball, shinny, etc.

The particular code of honor in a school, the things that are tabooed, and the general moral tone of the school also depend far more upon the school community than upon the teacher. We send our boys to be educated by the school-master, but the school-boys educate them. The moral tone of a school is very

[1] *Mental Development*, p. 358.

much affected by imitation. If a teacher can secure the co-operation of a few real leaders, it does much more to change the moral tone than any amount of lecturing or preaching. Get a few leaders started and the effect spreads like contagion. The teacher must always see to it that the leaders, those whose opinion is deemed important, are on her side. Public opinion is largely the opinion of leaders. This is true in politics, and equally true in school circles. This public opinion is a most powerful shibboleth. Let the teacher keep the leaders sympathetic. She can then run their opinions into any desired mould. With the leaders enlisted on her side and the cause of right, mere school government is an easy affair. The hearts of the multitude cannot be entirely changed all at once. Other counter influences may be strong, but when once the wide-spread influence of imitation is recognized; when it is comprehended that we are to imitate whether we will or not, there will be much more attention paid to the "copy" that is placed or allowed before children.

It is not a new thing for solicitous parents to try to keep bad and vicious companions away from their children, but they usually think little of the positive effects of good copy. The right kind of playmates for a child in its impressionable years may save many school bills, and even doctor's bills. It takes years and many school-masters to teach what ought to have been gained silently, surely, unthinkingly, through imitation of worthy associates, and to help unlearn the undesirable things learned by the same inevitable, imitative process from vicious companions.

Take, for example, the code with respect to "tattling." While any fair-minded person would denounce that kind of tattling which informs for the selfish satisfaction of getting the other fellow punished, yet who cannot see that not to inform against an enemy to common welfare is to be a silent partner to the crime? To be an informer against all enemies of the public is one of the most fundamental civic virtues. Yet a foolish misinterpretation of the literal expression has become a false code

of honor, fostered in school and perpetuated in civic life. How many shrink from attempting to right public abuses because the injury has not become so personal as to be felt! The public business becomes no part of any individual's business. As in school they felt it to be the teacher's business to right evils, they now turn it entirely over to the police, and then grumble at the corruption in public affairs. One can be a flagrant sinner "by minding his own business." There are sins of omission as well as of commission. Our greatest civic sin is neglect of the public weal. While we fold our hands, stop our ears, and blind our eyes the council barters away the franchise, the sheriff pockets his usurious fees, the tax-collector keeps all that sticks to his fingers, the money kings hide their taxable property, the corporations swindle the patient public, and the patent-medicine man saps the life and vigor from the commonwealth. We know all these things are going on, but we believe in "minding our own business." Children must be taught in school that a rebel against the welfare of the school is a public malefactor.

Nearly all the rules, regulations, and machinery of government in school are, in point of importance and efficiency, of minor potency when compared with the public opinion of the school. The school becomes what pupils sanction. The teacher who inspires high ideals of the relations the pupils should bear toward the school will have no difficulty in government. Many schools, regrettably, have never glimpsed true ideals of these relations, because the narrow teachers themselves have not comprehended them. The teacher who comports himself as a policeman and detective is surely imitated in his ideals, and usually plays a sorry game.

We hear, nowadays, much about self-government in schools. The tendency is to evolve a complex system of machinery whereby the pupils may themselves enact and execute laws and even punish offenders for their infraction. No system of school governmental machinery of itself, however, can secure self-government. The only secret worth striving to discover is that of se-

curing a feeling of mutual ownership of the school. That secured, the machinery is largely rendered unnecessary. Pupils are too apt to feel no sense of partnership in the school, and no sense of responsibility for its good name. School public opinion has thrown the whole responsibility upon the teachers, and instead of feeling happy in the success of the school, the pupils have even often felt a secret delight in the failure of what is to them some one else's affair. False codes of honor are by no means uncommon. Many a boy who would sooner cut off his right hand than inform the authorities of offences against their mutual welfare, would not hesitate to crib from his neighbors on examination. No teacher can abolish cribbing, hazing, or bullying by an edict, but once let him create a public opinion against it, and woe to the offender. Even little children will often commit flagrant disobedience of parents' commands rather than disregard the mandates of the public opinion of their own circle.

Social Responsibilities Because of Imitation.—The laws of imitation place great responsibilities upon every individual in society. Every one, unless isolated even more than Robinson Crusoe, is a part of somebody's environment. Every action has some influence upon others as well as upon one's self. Thus is each one his brother's keeper. When we come to understand the influence of others upon us, the influence other children exert upon our children, we shall then be more solicitous to secure only wholesome, elevating surroundings for ourselves and our children. We shall be almost as deeply concerned about educating our neighbor's children properly as we are about our own, for in the widest sense we cannot educate a given individual properly without suitable environment. Every man is a product of the time in which he lives. A great statesman cannot be produced without a great state. A great scholar rarely lives in an unscholarly time or place. Therefore every parent who wishes to educate his children in intellectuality, morality, and virtue must seek those conditions as an environment. No one who desires to educate his children properly, moves to the

slums; no, he moves where culture is highest, not because good teachers are not obtainable for the slum district, but because of all the other contributory factors. While many seek these conditions, few realize their duty in creating them.

CHAPTER XVII

SENSORY EDUCATION

The Doctrine of Innate Ideas.—"Nihil est in intellectu quod non prius fuerit in sensu." Wise words of Comenius written so long ago, but so tardily understood by the world! The psychological doctrine maintaining that all ideas are innate, which was held by most people down to the time of John Locke in the seventeenth century, led to its pedagogical corollary, that the purpose of education is not to supply ideas at all, but merely to draw out those already possessed by the individual. We read Socrates's proclamation that the science of teaching is a science of *maieutics*, or the science of giving birth to ideas. This view of the origin of ideas led men to seek knowledge of all things within themselves, and the final tribunal of the validity of all knowledge was the reason. Hence the Middle Age scholasticism was characterized by acuity of dialectical, deductive reasoning and extreme deference to authority. No experimental investigation was carried on, nature was not interrogated to give up her secrets, but premises, often fantastic, absurd, untrue, were set up, and conclusions deduced therefrom. The schoolmen spun exceedingly delicate webs of beautiful logic, but only to become hopelessly entangled in retarding, benighting veils of ignorance, superstition, and misdeed. Then followed the Renaissance, which was characterized by the assertion of individual, spiritual independence, and the severance of bonds of authority. Post-Renaissance teachers turned to the study of nature, but they studied it by proxy, *i. e.*, through the medium of books. They have been denominated in the history of education as *verbal* realists. Unfortunately, the verbal realists are not all dead yet. Verbal realists of the wordiest kind still exist, who, for example,

teach geography as a matter of definitions and book descriptions, who teach physics without laboratory and experiment, who read about chemical action instead of producing it and observing it, who teach civil government by requiring pupils to memorize the Constitution verbatim and never to see a concrete illustration of its workings.

Change from Utilitarian to Disciplinary Views.—Subject-matter in early schools was chosen because of its immediate utility in furthering the ecclesiastical ideal. With the Revival of Learning a new ideal appeared along with the old. The subjects which had been regarded as instruments then came to be considered as the sole ends of instruction. A blind worship of antiquity developed a fetichism for the means of ancient culture and expression. Dittes writes that "education in the form that it had assumed in the sixteenth century, could not furnish a complete human culture. In the higher institutions, and even in the wretched town schools, Latin was the Moloch to which countless minds fell an offering, in return for the blessing granted to a few. A dead knowledge of words took the place of a living knowledge of things. Latin school-books supplanted the book of nature, the book of life, the book of mankind. And in the popular schools youthful minds were tortured over the spelling-book and catechism. The method of teaching was almost everywhere, in the primary as well as in the higher schools, a mechanical and compulsory drill in unintelligible formulas; the pupils were obliged to learn, but they were not educated to see and hear, to think and prove, and were not led to a true independence and personal perfection."

Beginnings of Realism.—Painter has aptly summarized the beginnings of the new movement in the following words:[1] "By the side of narrow theological and humanistic tendencies, there was developed a liberal progressive spirit, in which lay the hope of the future. It freed itself from traditional opinions, and pushed its investigations everywhere in search of new truth. In England Bacon set forth his inductive method, by which he

[1] *History of Education*, p. 173.

gave an immense impulse to the study of nature; in France Descartes laid a solid foundation for intellectual science; and in Germany Leibnitz quickly reached the bound and farthest limit of human wisdom, to overleap that line and push onward into regions hitherto unexplored, and dwell among yet undiscovered truths. Great progress was made in the natural sciences. Galileo invented the telescope, and discovered the moons of Jupiter. Newton discovered the law of gravitation, and explained the theory of colors. Harvey found out the circulation of the blood. Torricelli invented the barometer, Guericke the air-pump, Napier logarithms. Pascal ascertained that the air has weight, and Roemer measured the velocity of light. Kepler announced the laws of planetary motion. Louis XIV established the French Academy of Sciences, and Charles II the Royal Society of England."

Karl Schmidt wrote of the time: "Books, words had been the subjects of instruction during the period of abstract theological education. The knowledge of things was wanting. Instead of the things themselves, words about the things were taught—and these taken from the books of the 'ancients' about stars, the forces of nature, stones, plants, animals—astronomy without observations, anatomy without dissection of the human body, physics without experiments, etc. Then appeared in the most different countries of Europe an intellectual league of men who made it their work to turn away from dead words to living nature, and from mechanical to organic instruction. They were, indeed, only preachers in the wilderness, but they were the pioneers of a new age."

Rabelais (1483–1553) introduced the first note of *realism* in his pedagogical writings as opposed to the *formalism of scholasticism.* The great Erasmus had even deemed it nonsense to wash more than once a day. But Rabelais, a physician, urged physical education and enjoined personal hygiene. An active life in the open air is the best antidote to paleness from book work. Lessons are to be followed by play. Of his hypothetical ideal pupil, Gargantua, he said: "He exercises his body just

as vigorously as he had before exercised his mind." Tennis, ball, riding, wrestling, swimming, and all known recreative exercises entered into the desired educational activities. He also wished to have his pupil secure his knowledge through personal observation and experience. The *Georgics* of Vergil are to be read while in the meadows and woods. Excursions are to be made, botany and geology are to be studied while "passing through meadows or other grassy places, observing trees and plants, comparing them with ancient books where they are described . . . and taking handfuls of them home."

Compayré, commenting upon Gargantua's training, writes:[1] "There are but few didactic lessons: intuitive instruction, given in the presence of the objects themselves, such is the method of Rabelais. It is in the same spirit that he sends his pupil to visit the stores of the silversmiths, the foundries, the alchemists' laboratories, and shops of all kinds—real scientific excursions such as are in vogue to-day." Montaigne joined in the reaction against empty scholasticism. He cared little whether the pupil learned to write in Latin. "If his soul be not put into better rhythm, if the judgment be not better settled, I would rather have him spend his time at tennis."[2] He argued that things should precede words, saying: "Let our pupil be provided with things; words will follow only too fast."[3]

Sir Francis Bacon (1561–1626) stands out pre-eminently among the pioneer exponents of the new doctrine of *sense realism* in education. The formulator of a new method, that of induction, he made men aware of an instrument of thinking of which they had not been conscious. Bound down to the methods of deduction as men had been for centuries, they had helplessly relied upon authority and tradition for all the knowledge handed down to them. During the period of scholasticism investigation proceeded only as necromancy, astrology, or alchemy, and was generally branded as a black art. Many like Roger Bacon, Bruno, Kepler, and Galileo paid dearly for their temerity in

[1] *The History of Pedagogy*, p. 97.
[2] Book I, chap. 24.
[3] Book I, chap. 25.

dabbling with the secrets of nature. Bacon's works were burnt, Kepler persecuted, Galileo forced to retract, and Bruno imprisoned, excommunicated, and finally burnt at the stake. Bacon holds up to ridicule the scholastic methods whereby men, "out of no quantity of matter, and infinite agitation of wit, spin cob-webs of learning, admirable for the fineness of thread and work, but of no substance or profit." He teaches the necessity for investigation, experiment, and individual verification of data. Man is implored to use his eyes, his ears, all his senses, in exploring the unknown universe. All study is to be made personal, concrete, and objective.

Comenius (1592–1670) pondered and expounded Bacon's inductive philosophy, and in addition seized the opportune moment for developing the educational psychology of sense realism which Bacon had only hinted at. In fact, Bacon had been interested only secondarily in educative processes but primarily in securing practical results. Comenius previses many of the most important biological laws of development and seeks to secure the natural unfoldment of the powers, bodily and mental, of the child. He is the first great sense realist, recognizing the function of the senses in revealing and reporting the world to the mind. He says: "It is certain that there is nothing in the understanding that was not first in the senses, and consequently, it is to lay the foundation of all wisdom, of all eloquence, and of all good and prudent conduct, carefully to train the senses to note with accuracy the differences between natural objects. . . . We must offer to the young, not the shadows of things, but the things themselves, which impress the senses and the imagination. Instruction should commence with a real observation of things, and not with a verbal description of them. . . . In the place of dead books, why should we not open the living book of nature? . . . To instruct the young is not to beat into them by repetition a mass of words, phrases, sentences, and opinions gathered out of authors; but it is to open their understanding through things. . . ." Comenius gave to the world the first illustrated text-book, the *Orbis Sensualium Pictus*.

It was a practical attempt to apply his new doctrine. The book achieved great popularity, being translated into every civilized language, and served as a model for innumerable imitations. He urged the importance of physical training. He also maintained that "the exact order of instruction must be borrowed from nature" and recognized that plasticity is greatest in childhood. He wrote: "A man can most easily be formed in early youth, and cannot be formed properly except at this age."

Meaning of the Renaissance for Education.—The breaking away from the enthralling methods of scholasticism is what the Renaissance stands for. The school of naturalists led by such men as Roger Bacon, Dante, Petrarch, Luther, Rabelais, Montaigne, Rousseau, Lord Bacon, and Locke, preached a new doctrine of individual intellectual liberty. Investigation instead of blind acceptance of authority became permissible. Facts were accumulated, their relations studied, and the conclusions tested by further investigation. With this new method science was ushered in. Everything in science that was known previous to the Middle Ages could be blotted out and the world would in no wise suffer. With the spread of Comenius's new doctrine that all knowledge takes its rise in the senses, new methods of teaching came as a necessary corollary. Objective and concrete teaching were a necessary consequence. No knowledge could be real which had not been gained at first hand. Words mean nothing unless they are the symbols of realities. Pursuant to this newer doctrine we have constructed laboratories, gathered museums, developed pictorial representation, encouraged excursions, counselled personal observation, and in multitudes of ways have tried to make knowledge real. To say that all teachers understand this and heed its mandates would be wide of the mark. Thousands are in the Middle Ages professionally, but the times are hopeful.

Importance of Sense-Perceptions.—Every one now readily admits that sensory training is desirable as a means of education. There is, however, much ignorance as to the real meaning of the process, and of the means to be employed in securing sensory

training. There are many who still teach as if all ideas were innate and the only function of teaching were to bring these ideas to consciousness through the medium of words. Little do they seem to realize that the child's whole mental life is determined and circumscribed by the range of his sensory experiences. Without these perceptions not only would the lower powers of the mind be lacking, but the growth of the higher powers, like judgment, reason, and volition, would be impossible. As Dexter and Garlick have asserted,[1] "Accurate sense-perceptions are the best and indeed the only preliminaries to accurate reasoning. . . . The teacher who tries to train the powers of judgment and reasoning upon incomplete and inaccurate sense-perceptions is like the man who built his house upon the sand. The wise teacher endeavors to build up the intellectual edifice upon the *rock* of well-ordered and carefully trained sense-percepts."

To show strikingly how important the education of a sense is, we may refer to those cases where persons have been blind and have later received the power of sight through an operation. A boy who had thus been made to see was shown his pet cat with which he was so familiar. He stared at it in amazement without being able to comprehend. Finally he took hold of the cat and felt her all over while looking at her. He gained a new idea entirely, and said, "Now, kitty, after this I shall be able to know you when I see you." Ziehen gives an illustration which shows that modes of perceiving become so persistent that it may even be impossible to establish the mode "natural" to normal persons. He writes:[2] "A certain individual, who had been born blind, was unable to form any idea of a square, even upon seeing it after his sight had been restored by an operation, until he began to perceive a sensation in the tips of his fingers as though he were really engaged in touching the object at which he was looking. The patient had constant recourse to his sense of touch, just as the normal man resorts to his sense of sight in the recognition of objects."

[1] *Psychology in the Schoolroom*, p. 99.
[2] *Introduction to Physiological Psychology*, p. 87.

A similar case has been reported by Dr. Miner from the psychological laboratory of the State University of Iowa. It is probably the best study on record of such cases, from the psychological point of view. The subject, Miss W., had complete cataracts in both eyes, and was reported as blind from birth. Both cataracts were removed by Dr. L. W. Dean, professor of opthalmology in the University of Iowa. At the time of the operation she was twenty-two years of age, and had received the high-school education in the State School for the Blind. Dr. Miner's investigations were conducted nearly three years after sight was restored to the right eye, and nearly two years after the operation upon the left eye. Among other tests, Dr. Miner made a very careful study of her stock of visual knowledge, and her mode of acquiring visual ideas. Even after the considerable time that had elapsed since she began to acquire ideas by sight, she was found very deficient in this respect. In Dr. Miner's words, "Miss W. was still completely naïve to many of the normal experiences of an adult. She had never looked through a stereoscope, opera-glass, field-glass, or telescope. She had never used both eyes together enough to find out any differences between monocular and binocular vision. She had not yet learned to translate her visual images into terms of movement with any degree of success, except in case of the most simple forms and numbers, or with common objects of her previous touch experience. She knew practically nothing about drawings or pictures. She had not even learned to identify people by their faces; those whom she thought she knew by their features were her mother, father, sister, a teacher at the school, and the nurse who was with her during the operation. Although I worked with her every day for over a month, and she saw Dr. Dean often, I believe she cannot recognize either of us by sight." She recognized persons mainly by the sound of the voice. She possessed an "all-powerful impulse to explain anything new by referring it at once to the language of her sightless experience." In counting the sides of a hexagon, for example, she used some sort of muscular movement to register

each number. "She would tap with her fingers or foot, press her teeth together, or her tongue against her teeth, move her head, regulate her breathing, or even slightly wink at each corner, in order to register that as number one before passing to the next." For a long time shadows seemed like real objects to her, and she often walked around them. Because she could not judge distances accurately, she frequently upset dishes on the table. In learning through reading or hearing, she repeated everything to herself, translating everything into motor terms.[1]

If a child is blind from birth it is therefore deprived of a class of experiences which can never be acquired through any other means. Stop the ears of the same child and another gateway of the soul is closed. Suppose the same child is deprived of the senses of taste, of smell, of temperature, of weight, of direction, of touch—and all the rest. What happens? All of the gateways to the soul are closed and the child grows up mindless—an idiot. Each sense supplies the mind with information of its own peculiar sort. The eye is fitted to respond to waves of light, the ear to waves of sound, and no other part of the body can act as a substitute. The eye is dead to waves of sound, the ear to light, and the sense of touch does not respond to odors. One who is deprived of a single sense, or who is defective in that sense, is caused to limp mentally just as surely as one must limp when a leg is amputated. Helen Keller has never known color as those of us who see it know it. She knows nothing of the melodies of sounds in nature as we who hear know of them. It should be remembered, also, that exercise of the senses must be secured at the right time. If early life passes without ample opportunity for sensory exercise, arrested development ensues, almost as disastrous as if the centres had been destroyed.

Meaning of Sensory Training.—By training a sense, we mean acquiring a rich fund of experiences through that sense, thus enabling one to react to a great variety of stimuli which come to

[1] Miner, J. B., "A Case of Vision Acquired in Adult Life," *Psychological Review, Monograph Supplement*, March, 1905.

that sense. An untrained sense is one which reacts to only a few of the stimuli which might awaken it. Images of flowers, of the rainbow, of works of art, strike the retina of the dog, but are unseen in any real sense; the strains of Beethoven's sonatas strike the untrained ear of the child and awaken no responsive chords; the unlettered man views a page of print and sees only black pothooks and crooks; each one of us goes about the world blind, deaf, and anæsthetic to manifold stimuli from light, sound, touch, taste, and smell. The end organs of sense may be perfect, the sensorium in the best of health, the nerve connections unimpaired, yet we are blind as bats and deaf as adders to myriads of stimuli. One may even be an expert in certain realms of sight, sound, or touch and yet be almost idiotic in other realms of sight, sound, or touch. For example, the trained telegrapher's ear may be without the slightest appreciation of musical harmonies, the hawk-eyed Indian looks with dull psychic vision upon the printed page, while a proof-reader might readily get lost in woods where the Indian would note and remember every rock, tree, and pathway. The shrewd agriculturist who sees the fine points in a Percheron, a Durham, or a corn-field, may be oblivious to the connoisseur's criteria of a classical painting. Dr. Hinsdale has said: "The Indian's boasted faculty is limited to his native environment; introduced into Cheapside or the Strand, he sees nothing compared with Sam Weller or one of Fagin's pupils."

The point is, that training the senses means acquiring rich funds of experience through the senses in order to interpret still larger funds of experience by means of the knowledge previously acquired through personal experience. The botanist has well-trained eyes for things botanical, the geologist for things geological, the grammarian for fine points in grammar, and the milliner for spring fashions. It is quite possible that a given individual may have all his senses keen, and be alert in a great variety of directions. That is an ideal development. Well-trained senses mean a mind richly supplied with apperceptive material gained from a variety of objects, received through a

variety of stimuli. Hence, the purpose of sense-training should be, first, to utilize the senses in gaining first-hand experiences from the world of objects about us; and second, to gain this knowledge in as many ways as possible. The one who *hears* music only gets a limited experience. The one who *sees* the printed notes and observes the musician and the instrument gets added perceptions; the one who actually *produces* the same music gets decidedly more and better perceptions than the other two. Musical knowledge is indeed imperfect until the last type of experience is added to the others.

In considering sensory training, the function of the nervous system, especially the brain, must not be forgotten. Sight, hearing, touch, and all the rest would be impossible without the cerebral cortex. Sever the optic nerve and we have a world of darkness; destroy the auditory nerve and all is hushed and silent as the tomb. The end organs may be perfect, the conducting or afferent nerves unharmed, but if the specialized central areas are functionless the signs given through the end organs of sense remain untranslated. Halleck says[1] that "psychic blindness is lack of recognition of an object that is actually seen. Thus, when the brain of a frog or a pigeon is removed, the animal may still see objects and avoid them when it moves, but the fact that such a pigeon has no fear of a cat or any other object shows that psychic blindness exists. Objects are seen, but not recognized. Sensorial blindness exists when no sensation from light is experienced. A Scotchman met with an accident that brought on him psychic blindness. He saw physically as well as ever, but he could not interpret what he saw. He would look at the most familiar objects and be utterly unable to recognize them. He would gaze at his New Testament without knowing what the object was until he ran his hand over the smooth cover, when he immediately recognized it. When a piece of detached bone, pressing on the centre for vision in his brain, was removed, he recovered his power of mentally interpreting what he saw."

[1] *Education of the Central Nervous System*, p. 17.

Real Beginnings of Sense Training.—Sensory training begins at birth, and should be kept up through life. We should not proceed as though we were going to exercise until reaching a standard of cultivation, and then expect the same proficiency in the given sense for all kinds of objective material. That is, there is no general training which will secure equal development for all kinds of special knowledge. The complete meaning of this will be discussed under the topic of Formal Discipline. The aim should be rather to use the sense to the best advantage as a means of knowledge-getting. Constant use and practice will improve the various powers involved so that general strength results. The basis of sensory training is contact with objective reality. By force of circumstances the child receives innumerable sensory stimulations through light, sound waves, physical contact with things, etc. Myriads of stimuli come to the child unsought, many undesired and many undesirable. So James says "the world presents itself to the child as one big, buzzing, blooming confusion." For the first six or seven months, till the child can sit alone and reach for things, there is no need of providing sense stimulation; till then, a reasonable amount of quietude will be more difficult to secure than excitation. From the time the child can sit alone or grasp things and carry them to his mouth, he should have various objects to sample. The percepts thus slowly gained are indispensable to future higher attainments. The ear that is closed, the eye that is blinded, is not only lost as an avenue of knowledge, but the mind of the possessor is circumscribed and dwarfed because lacking certain fundamental kinds of knowledge. The congenitally blind can never know color, though they learn its entire nomenclature; their knowledge of form, size, and perspective is circumscribed; while they can never know complex things as wholes as the seeing do. The deaf have no concept of sound—only word ideas about it.

The child's building-blocks furnish much valuable sensory material. Laurie believes that "the flat brick with toothed ends, admitting of one being fitted into another, is of more value than

all the Froebelian gifts." [1] As soon as the child creeps he begins to get ideas of an extended environment. With walking he is put in possession of a means of exploring an enlarged world. During early years the child should come into direct personal contact with a large range of objects. The field, forest, and factory should all be explored and examined. He should literally and figuratively leave no stone unturned in his investigations and explorations. Not only should unharmed nature and primeval forests be interrogated, but applied science has furnished multitudes of examples as worthy objects of inspection. The microscopic features, the visible workings, and many of the whys relating thereto should be learned concerning all the objects reasonably accessible. What nonsense to first study steam-engines, telegraphs, plants, animals, birds, and rocks from books! The only excuse for book study at all is that we may study things not accessible and that we may be enabled in advanced stages to study the object to advantage. Darwin's epoch-making contributions could never have appeared had he not examined at first hand a large part of the material mentioned. No progress in any line of science or art is ever made by those who have not an observational knowledge of the objects of their search. The astronomer sweeps the heavens with his eye, bringing to the aid of his limited vision distance-annihilating telescopes, and the biologist searches in the laboratory with eyes made a thousand times acuter by the microscope. "Aristotle knew the importance of asking nature for facts, and he induced his royal pupil, Alexander the Great, to employ two thousand persons in Europe, Asia, and Africa for the purpose of gathering information concerning beasts, birds, and reptiles, whereby he was enabled to write fifty volumes upon animated nature. After teachers had forgotten his methods they still turned to his books for the treasures which he had gathered." [2]

Function of Guidance.—In the tender years of childhood the chief thing is to provide sufficient opportunities for personal

[1] *Institutes of Education*, p. 117.
[2] Schaeffer, *Thinking and Learning to Think*, p. 61.

observation of a wide range of objects. Though the child may be aided by suggestion and question, and by having his interrogations satisfied, too much surveillance should not be exercised. Some believe that no guidance whatever should be exercised, but this is manifestly an extreme view, and erroneous. For example, a goodly part of the aural sensations emanate in speech. Surely he should be shielded from hearing harmful or vicious speech and should be guided in its reproduction, being even consciously trained in the correct utterance of difficult combinations to insure against fixed habits of mispronunciations. Sights worthy of view and unsuggestive of evil should certainly be selected, while demoralizing actions should be religiously guarded against. When the child begins reading, there must be very definite guidance in correct vision and in accurate imitation of phonetic combinations. This means auditory training also. Touch is trained in walking, writing, talking, posing, etc.

Training should not degenerate into formal gymnastics, but should be a means to an end. Only in this way can interest be maintained and proper cultivation secured. Training which subserves a useful end is as superior to seeing and hearing for the sake of hearing and seeing, as going to some definite place is superior to merely lifting the feet and setting them down in a treadmill. But when either physical or mental exercise degenerates into merely obeying directions without comprehension or interest, the pupil's time is worse than wasted. Mere idleness were usually better. For training the senses a good many writers have prescribed artificial exercises, wholly dissociated from any desired end. The results must be stultifying. The conscious aim should not be to train the power, but to use it intelligently in acquiring knowledge. The training will take care of itself if the power is employed naturally in acquiring knowledge possessing intrinsic worth. Possibly a game might be made of the exercise so that a little zest would enter in; but to have just so much seeing, so much hearing, so much smelling, so much tasting, and so much finger-bending each day would be

a splendid example of formal discipline. Unfortunately, I have seen just such exercises and for the purpose of formal discipline. Even physical work in a gymnasium can be carried on only under the stimulus of a game, the acquisition of a bold feat, or something of the kind. So in school training a definite end enlisting the right emotional attitude should ever be present.

Laurie remarks:[1] "Some people would make the child exact from the first. . . . Let the child alone: let him be the victim of the myriad sensations which pour in on him. The soil may be growing nothing, but it is being fertilized with a view to a future harvest. It is mere pedantry to interfere at this stage, and the result will be, or ought to be, narrow and pedantic. By all means provide raw material for the child, but leave him alone to make what he can of it. By all means give him paper, and pencils, and painting brushes, and colors, and bricks, and spades; but let him alone. We were not sent into this world to be manufactured by pedants, but to grow from our own roots and soil. Up to the age of six, whatever else is done, let there be no interference with the freedom of sensation, but rather encourage contact with all forms of existence, and promote the natural activity of the child in every direction."

The training begun before school-days should not be abandoned on entering school. Increased opportunity for more extended observations should be afforded. The training should become more intentional, more definite things should be seen, and descriptions, at first oral, of what is seen should become daily more accurate; though indefiniteness, vagueness, naïveté, must be expected through many years. A great variety of things must be brought to the child, when impossible to take the child to them. That is, specimens, samples, pictures of the great, busy world, should be collected into museums, cabinets, and laboratories, where children may learn of nature, art, industries, marts of trade, commerce, shipping, mining, etc. A chance to see and examine the local region under competent guidance should be afforded every child. For, unfortunately, the

[1] *Institutes of Education*, p. 115.

pupil often first becomes acquainted with his home locality through reading. The knowledge thus acquired never possesses the vividness and interest that real personal acquaintance gives its possessor. Field, forest, and stream should be explored and importuned to yield their secrets. The children should, like Shakespeare's Duke, find "tongues in trees, books in the running brooks, sermons in stones, and good in everything."

Object-Lessons.—The purpose of object-lessons is to bring to the learner first-hand experiences. Object-lessons are begun in the cradle and should be a part of daily experiences throughout life. The object-lessons of pre-school days have been unsystematic, largely fortuitous, unpremeditated, and in a large measure have not been the cause of purposive reflection. In school object-lessons are to be given with definite purpose and intended to make clear certain fundamental facts. They are also to be considered relationally for the purpose of causing reflection. It is not to be understood that a "course in object-lessons" is to be given. Objective illustration should be a part of the instruction in each and every branch in school. Objective illustration is necessary because "all knowledge takes its rise in the senses." Objective illustrations should be given *whenever the elemental ideas in any topic are not easily cognized through imagination and reflection.* Their necessity is as great in the university as in the primary school. In the words of Dr. White, "the primary ideas should be taught objectively in all grades of school." The meaning of *primary* or *elemental* ideas needs to be understood. The mind can image any material or any combination of material things, provided the elements have been derived through perception. Once transcend experience of the elements and blankness results. As the congenitally blind cannot image color, nor the congenitally deaf, music, a normal pupil cannot image a machine unless he has actually seen the parts. A new machine as a whole can, of course, often be studied as well in diagram as from the object itself.

Object-lessons are as much a part of reading lessons as of chemistry. Whenever fundamentals are lacking through ex-

perience they should, if possible, be supplied by objective illustration or pictorial representation. (See Imagination.) A caution needs to be offered against too prolonged continuation of the objects. Just as soon as sensory experience has been made clear the object is no longer needed. In fact, its continuance will be positively harmful. Sensory experience is the lowest form of knowledge, and is only the raw material for a finer web of thought. Dealing with sensory experience when the child should be reflecting will surely produce arrested development. As Dr. Hinsdale has so well said, "the Realists have deservedly emphasized the value of sense-perception and of sense-teaching in education; but they have not emphasized the facts that the particular and the concrete mark an early and imperfect stage of mental advancement, and that there is no greater clog upon mental progress than the habit of *thinking it,* and that a man's thinking capacity is gauged by his power to think general and abstract thoughts. Children and savages—all immature minds —live in their senses; cultivated men grow out of them. . . . The savage is as weak in speculative reflection as he is strong in keenness of scent. . . . That is a significant anecdote which Dr. Fitch relates of the teacher who was testifying before Lord Taunton's Commission as to the extraordinary interest which his pupils took in physical science. Asked what department of science most interested his scholars, he replied: 'The chemistry of explosive substances.'"[1]

In gaining ideas of number, the child must derive his first notions through experiences with concrete things. He must learn through actual experiences, the relative magnitude of numbers, the magnitude of number series, and in the same way secure a correct idea of the process involved in the various computations. But it is pedagogically unwise to have the pupil learn every fact and every process objectively. For example, $3 + 2$ or 3×2 may be learned objectively, but $9 + 8$ or 9×8 never should be. These latter should be taken as authoritative statements, unquestioningly. Who knows from objective ex-

[1] *Studies in Education,* p. 50.

perience that $9 \times 8 = 72$? Whoever first learned it that way is to be pitied. The child knows from counting that 8 9's are more than 7 9's, and also knows from counting the relative places of 63 and 72, so that when $9 \times 8 = 72$ is told him it seems reasonable. If the table were built up rationally, step by step, he would not believe that $9 \times 8 = 14$, but he could easily be made to believe that it equals 73. Many things that we never demonstrate nevertheless fit into our rational thinking so as to do no violence to the usual currents of thought.

Dr. Schaeffer instances a school in which the principal proposed concrete work in fractions. "The teachers and pupils began to divide things into halves, and thirds, and fourths, and sixths. They added and subtracted by subdividing these into fractions that denoted equal parts of a unit. Whilst the charm of novelty still clung to the process, a stranger who visited the school asked one of the teachers how the pupils and parents liked the change. 'Everybody is delighted,' was the exclamation. A year later the same teacher was asked by the visitor, 'How are you succeeding with your concrete work in fractions?' With a dejected air she replied, 'We are disappointed with the results.' 'Just as I expected,' exclaimed the visitor; 'for you were making the children think on the level of barbarism, instead of teaching them to use the tools of labor-saving machinery of modern civilization."[1]

As far as possible, object-lessons should be given in their natural setting. The object-lesson apart from a life interest does not compare with one that grows out of a consideration of things in their natural surroundings, and studied as a part of every-day life. Dewey may be quoted apropos of this point:[2] "No number of object-lessons, got up *as* object-lessons for the sake of giving information, can afford even the shadow of a substitute for acquaintance with the plants and animals of the farm and garden, acquired through actual living among them and caring for them. No training of sense-organs in school, intro-

[1] *Thinking and Learning to Think*, p. 91.
[2] *The School and Society*, p. 24.

duced for the sake of training, can begin to compete with the alertness and fulness of sense-life that comes through daily intimacy and interest in familiar occupations." In all branches of instruction it is important to gain as many ideas as possible through objective illustration. The material sciences are not the only ones that demand laboratory methods. The schoolroom with apparatus is not the only real laboratory. The schoolroom laboratory, in fact, is only a miniature controllable representation of certain fundamental laws or facts of the great laboratories of nature and of life. Teachers of science should vitalize their work by utilizing these greater laboratories, by affording opportunities to inspect them, and by continually showing the applications of all laws and principles in every-day life. In fact, applications are more apt to interest than are the detached illustrations.

Excursions.—In Germany the school journey is a unique and invaluable means of making instruction real. Not only are brief excursions made frequently into the immediate locality, but many schools make periodical journeys lasting from three to six days. In the former the pupils become thoroughly conversant with the points of geographic and historic interest, and with the life, about them. This gives an apperceiving background for the things not accessible. How many of us have studied the botany of rare plants and been ignorant of dozens of common species within a stone's throw of our door, or have studied rare rock formations from a book when an hour's tramp would have made every point tangible. The longer journey may not be feasible in a sparsely settled region, but in New England and in some other parts of the United States it could be carried out to good advantage.

Efficiency of the Sense-Organs.—After showing at such length the exceeding importance of sense-perceptions for all phases of mental life, it scarcely needs argument to show the importance of keeping the child's sense-organs in the highest possible state of efficiency. Yet how many parents and teachers are continually negligent in this important matter. The sections on sight

and hearing set forth through definite statistics the alarming prevalence of defective senses. Astigmatism, myopia, color-blindness, partial deafness in one or both ears, insensibility to pitch differences, total blindness in one eye, total deafness in one ear, are not at all uncommon and oftentimes are unsuspected by the sufferer. The discussion of heredity admonishes us of the great probability of the perpetuation of these infirmities through generation after generation.

How important that teachers be cognizant of these facts and that they be sympathetic with children thus afflicted! Many a poor child has failed and received harsh criticism from his teacher though he has done his best. He has been adjudged obstinate and perverse when he is the victim of circumstances over which he has had no control. The teacher needs to possess sympathy and patience in dealing with such cases. More than that, he needs scientific knowledge enabling him to detect defects. Dr. Schaeffer pointedly remarks:[1] "In cases of defective eyesight the first step toward the solution of the spelling problem, as well as the first condition in teaching the pupil to think accurately, is to send him to a skilled oculist. . . . Correct vision will assist the pupil not merely in learning the exact form of the words which he uses in writing, but also in forming correct ideas of the things with which the mind deals in the thought-processes." Then there should be the school physician ready to pass expert judgment on suspected cases. The school nurse, in large cities, should be at hand to minister to those temporarily disqualified for efficient work. Greater intelligence upon these matters would cause the child with defective senses to be given more advantageous positions in class, relieved of certain kinds of work, be given extra time, etc.

It is important to bear in mind that nearly all children begin reading and writing too early. They are naturally far-sighted, and the excessive strain of reading and writing when immature causes near-sightedness. Altogether too much work is copied, and usually from the black-board, under atrocious conditions.

[1] *Thinking and Learning to Think*, p. 51.

The written examination is fit only for mature persons, but little children are annually tortured on this rack. No formal written examination ought to be given below the seventh grade. From there on they should usually be shorter than they are. It is a sad commentary on our methods of teaching that the higher the state of education, the more defective in senses and bodily conditions people are. Could we but preserve the Greek ideal of harmonious bodily and mental development the race would grow stronger and more perfect in every bodily feature. There are many evidences of a return to that beautiful ideal. May its universal acceptance be speeded!

In regard to the importance of tests for sense-defects, Kotelmann wrote:[1] "It might naturally be supposed that a deficiency in hearing so small as to be ascertainable only by means of a watch or a whisper, that is, by a delicate test, could be of no special disadvantage to pupils, on the ground that they can follow the recitations in spite of it. But this would be an erroneous notion. Of all the requirements made of the ear, one of the most difficult is the understanding of language. The cause of this is the great number of consonants that are crowded together; since these have the nature of noises, they are not so readily apprehended as the vowels, which are more like musical tones. . . . The ear catches the spoken word as an entirety, needing often only a few characteristic sounds for the purpose. For this reason a pupil with defective hearing can for some time correctly understand lectures, dictations, and similar exercises; but his attention will gradually weaken under the severe strain, and by failing to hear one or more words he may lose the sense altogether. A pupil with normal hearing can in such a case usually catch the connection from what follows; while the pupil with defective hearing finds it much more difficult to do so. His embarrassment is especially great when new words are involved, as is often the case in foreign languages, history, geography, and natural science, because he finds it impossible to fill out the part of the word which he does not hear." And because

[1] *School Hygiene*, p. 282.

his perceptions are vague and indefinite his concepts are of the same character and his memories of the subjects rapidly disappear.

Relation of Books to Sensory Experiences.—One of the commonest mistakes is to make teaching simply a matter of words. From the very fact that schools have properly so much to do with books, it is easy to regard teaching as a mere matter of memorizing the words of books. It should be remembered that books do not deal directly with realities. They only contain records *about* realities. The realities must be acquired through personal examination of the realities themselves. Text-books must be regarded as texts; the sermons must come from outside sources. To be sure, books should serve to reveal knowledge which one might not get so readily or not at all by studying the realities alone; but they can only do this when they constantly appeal to experiences realized. This is true of the knowledge of a dynamo, a potato, or a rock; it is also true of a psychological fact, or a philosophical theory. The dynamo is only known when it has been made real and is comprehended through experience; likewise one knows nothing of a psychological law until he has realized it through his own personal experience. "Not psychology but to psychologize" should be the end sought in that study.

A boy could never really *know* skating by hearing lectures upon the process. The only way to realize it is to skate. The only way to know dancing and writing is to dance and to write. The only way to know how to saw boards and make joints is actually to do those things. The teacher should scrutinize every step in every subject and inquire: "How can I cause the boys and girls really to know this step?" If this were done in every school-room in the land the educational millennium would soon appear on the horizon. Dewey wrote: "What is primarily required is first-hand experience. Until recently the school has literally been dressed out with hand-me-down garments, with intellectual suits which other people have worn." And we might add that like all borrowed garments, they are usually misfits.

Dr. Gordy[1] aptly compared words to paper money, and consequently, like paper money, "their value depends upon what they stand for. As you would be none the richer for possessing Confederate money to the amount of a million dollars, so your pupil would be none the wiser for being able to repeat book after book by heart, unless the words were the signs of ideas in their minds. Words without ideas are irredeemable paper currency. It is the practical recognition of this truth that has revolutionized the best schools in the last quarter of a century. . . . In what did the reform inaugurated by Pestalozzi consist? In the substitution of the intelligent for the blind use of words. He reversed the educational engine. Before his time teachers expected their pupils to go from words to ideas; he taught them to go from ideas to words. He brought out the fact upon which I have been insisting—that all they can do is to help the pupil to recall and remember ideas already formed. With Pestalozzi, therefore, and with those who have been imbued with his theories, the important matter is the forming of clear and definite ideas."

Some Ways and Means.—Twenty-five years ago, when I was in the high school, we studied physics by the book method. Not a single piece of apparatus did the school possess—much less a laboratory. Not a pupil in the class performed an experiment, nor did the teacher. The nearest approach to the study of realities was through the good diagrams and pictures in the text and the diagram occasionally drawn on the black-board. Astronomy, zoology, and geology were studied in the same school and by the same barren verbal method. I think chemistry was also studied. Had there been real chemicals and an occasional explosion I am sure that I should remember the fumes and the explosions. Later pursuit of this subject in a real laboratory left me a very definite remembrance of the nature of chemistry. In the study of botany we fortunately had a teacher fresh from a university, and we studied real, live, growing plants. Unfortunately the main end seemed to be names and classifications,

[1] *Lessons in Psychology*, p. 260.

but in spite of that we handled plants, tramped through swamps and over hills, tore our clothes in the thickets of brush, and discovered where the plants grew, when they grew, and how they grew. Those impressions will always remain. Time and distance, and other impressions cannot efface them. They were my own personal experiences, my own ideas and not Gray's nor Apgar's, nor my teacher's. They are mine still.

In teaching arithmetic it is so easy to contrive means of affording sensory experiences and of making things concrete. All measures of length, areas, volume, weights, capacity, etc., can be readily objectified. Unless gained concretely they never mean anything. Children may recite glibly tables of denominate numbers and not have a single definite notion of what they are mouthing. An acquaintance of mine relates that when a boy back in Ohio, one day when they were studying the animals of the Rocky Mountains, an itinerant bear-trainer with three Rocky Mountain bears passed that way and stopped in front of the old log school-house. Here was a grand chance to let the children see the real thing. What did that teacher do? True to her training and ambition as a strict disciplinarian, and true to her ideal that book learning was what the school was maintained to give, she sternly ordered all to cease looking out of the windows, even rapped some on the head, and commanded: "Study your books!" Recently a teacher told me apologetically that when Barnum and Bailey's circus and menagerie was in the city she allowed the children a quarter-holiday, and added still more apologetically: "I really think they learned almost as much as if they had stayed in school." My answer was: "Why, bless you, they learned more in that quarter-day about animals and many wonders of the world than your school could have given them in ten years! In fact, the knowledge they gained there you could not give them at all. By all means dismiss school every time a great circus and hippodrome is within reach of the children. The menagerie will furnish your boys and girls geography, natural history, and language lessons, such as no school on earth can give."

Kindergartners have struck the right key-note in their theory of sense-training, but many kindergartners interpret it altogether too narrowly. They seem to regard the "gifts" as the sole means of sense-training. By limiting their activities to the few wooden blocks they make the entire kindergarten work in many quarters altogether too "wooden." The whole range of work in the kindergarten and the primary school has been vitalized in other places by utilizing a multitude of objects and activities common to the child's every-day environment. Things in the home, household activities, work in the garden, street scenes, field, forest, mountain, and stream; the mill and the factory, as well as the country, must all be contributors to the wide range of experiences which every child should receive.

Let us remember with Dr. Hinsdale[1] that "every sense and every educational agent has its own appropriate function that no other sense or agent can fully discharge. A man blind from birth may learn the whole color vocabulary, but he can have no conception of its meaning. The appropriate sense must always furnish a starting point from which the mind may work through the other senses in the direction of substitution. Similarly, language, writing, and pictures can never take the place of a suitable grounding in the primal realities of sense and of the spirit. This fact must not be obscured. No human being's cultivation ever began with words of wisdom. The library is a sealed book, save to him who already possesses the keys of knowledge. The command to keep out of the fire is significant only to those persons who have already learned by experience what the fire is. In this primal sense, therefore, the education of all men starts at the same place and proceeds by the same steps."

The School of Life.—We must not assume that the child secures all his education within the four walls of a school-room and from his text-books. As set out in the introductory chapters and as emphasized in every subsequent one, the whole of life is education. The school should be the best interpreter of life and should furnish more tools than any other source for the

[1] *Studies in Education*, p. 31.

work of life, yet many, if not the most important educational lessons must come from outside the school. The extent of the child's extra-school experience determines the manner in which he shall appreciate what we attempt to teach him. Years before the child knocks at the school-house door, and during his school age for many more days and hours than he is conning his lessons, he is acquiring by nature's method more and better than we usually teach him. In "The Barefoot Boy," Whittier has beautifully expressed a profound educational idea and shown us how independence of thought should be acquired, and that life is the greatest school. He praises the boy for his

> Knowledge never learned of schools,
> Of the wild bee's morning chase,
> Of the wild flower's time and place,
> Flight of fowl and habitude
> Of the tenants of the wood;
> How the tortoise bears his shell,
> How the woodchuck digs his cell,
> And the groundmole sinks his well;
> How the robin feeds her young,
> How the oriole's nest is hung;
> Where the whitest lilies blow,
> Where the freshest berries grow,
> Where the ground-nut trails its vine,
> Where the wood grape's clusters shine;
> Of the black wasp's cunning way,
> Mason of his walls of clay,
> And the architectural plans
> Of gray hornet artisans!
> For, eschewing books and tasks,
> Nature answers all he asks;
> Hand in hand with her he walks,
> Face to face with her he talks.

Halleck remarks that "If the child's knowledge reaches to a solid foundation of sense-training like this, the floods of time will beat in vain upon that knowledge. Other things may pass away, but that remains while the brain lasts." He argues at great length that country environment has proved most conducive to the development of great intellects. He cites in proof of his contention the names of Shakespeare, Milton, Cromwell,

Addison, Bunyan, Dryden, Johnson, Byron, Longfellow, and many others who were illustrious and who were profoundly influenced by rural environment. He concludes his array of facts with the following statement: "A study of the early history of these eminent men has shown that the majority of them had their sensory brain tracts developed to a considerable degree by the incomparable stimuli of the country. Since there is more room for exercise in the country, more green fields in which to romp and play, more groves and forests in which to wander, the motor tracts are likely to receive better training in such tempting environment. Again, we notice that nearly all these men travelled either in their own land or abroad. This is what we might have expected, since a study of the nervous system, and especially of the laws of attention, has shown that unvarying stimuli gradually elicit less and less attention, although they may be of the very finest sort. A change in this environment is occasionally necessary to awaken us thoroughly and to make us men of action." [1] Country environment is undoubtedly conducive to the child's best mental development, first, because it furnishes stimuli which are simple and comprehensible at that stage of development; second, because there is also greater opportunity for freedom, thus allowing the child to follow lines of interest; and, third, because his growth is not forced. The city is too complex, too intricate, and too much like a hot-house.

Training in Observation: Meaning.—Before discussing methods of training in observation it will be necessary to indicate the meaning of the expression "training *in* observation." Most writers employ the phrase "training *the* observation" as if there were a general power or faculty called the observation. It has been considered as if it were co-ordinate with memory, imagination, etc. (Even these we no longer regard as general faculties but as the sum of powers manifested in particular directions.)

But observation is not co-ordinate with these, for it is not a faculty but a process, involving several faculties. To observe means primarily to perceive. Now, perception means more

[1] *Education of the Central Nervous System*, p. 92.

than merely receiving physical impressions of light, sound, pressure, etc. It means attentively fixing the mind upon some object and giving it careful mental scrutiny. Perception is a mental act involving many of the so-called higher powers of the mind. Every perception includes comparison, discrimination, and judgment in some degree. It involves, in a rudimentary way at least, all the highest phases of mentality. One of the greatest mistakes in psychology has been in regarding each power of the mind as if it were independent. Every mental product higher than an undifferentiated and unlocalized sensation has involved in its formation to some extent the use of all the elements of the higher powers. To form even the simplest percept there are necessitated acts of memory, imagination, comparison, discrimination, and judgment. Perception being a mental act does not end with the formation of a retinal image, the vibration of the Cortian fibres of the ear, or the excitation of the Pacinian corpuscles of the skin. Perception as a process means the interpretation of elements gained through sensations. It means that sensations are viewed in the light of past experiences and evaluated in terms of the resultants as then cognized by the mind. In perception they are recognized in their relation to other mental products then in the focus of consciousness or immediately called into the focus through associative laws. Thus every perception is an acquired perception.

Observation and Apperception.—Observation means fixing the mind upon an object and attentively viewing it. Only by voluntarily focusing the attention and bringing to bear all one's past related experience can one really observe. In a scientific observation often special conditions must be created under which a particular feature may be viewed, or special apparatus may be necessary in order to make the observation of value. In order to have the observation of any object full of meaning there is then presupposed a rich fund of experience of an allied nature. Otherwise the perception is devoid of content. Dr. W. T. Harris says: "It is not perception pure and simple that makes observation, but it is rather what is called *apperception*

(the use of the stored-up results of the aggregate perception of the race) that gives us power to see new objects and explain familiar objects."[1] Not all perceptions are correct, even if careful attention has been given to them. The senses do not deceive us, but our interpretations may be erroneous. We view all phenomena with glasses colored by all our previous experiences. Our world is what past experience makes it. Because of faulty observations which are assumed to be correct, oftentimes exceedingly erroneous judgments are perpetuated, through experiences of individuals not being accurate enough to detect the errors. Dr. Whewell writes that "A vague and loose mode of looking at facts very easily observable left men for a long time under the belief that a body, ten times as heavy as another, falls ten times as fast; that objects immersed in water are always magnified, without regard to the form of the surface; that the magnet exerts an irresistible force; that the crystal is always associated with ice; and the like."[2]

Observation and Attention.—Effective observation presupposes concentration of effort. But in attempting to teach pupils to observe, teachers frequently proceed exactly counter to the psychological laws governing the processes. They urge children to "notice everything about them on their way to school," they impress upon them the idea that they ought to "know everything that is going on about them," that they must "keep their eyes and ears open to everything," etc. Now, good observation means careful observation, seeing with reflection, dipping beneath the surface and not skimming it. It means concentration of attention upon the thing to be observed. Careful attention to a given object necessitates inattention to all other things. In a part of school work pupils are taught to be inattentive to objects which should not concern them in order to attend properly to things that rightfully should occupy their attention. We wish them to attend to their arithmetic, their reading, or their spelling and to ignore the classes that are reciting in the same

[1] Preface to E. G. Howe's *Advanced Elementary Science.*
[2] Whewell, *Novum Organum Renovatum*, p. 61.

room, to ignore the boys that are walking about, the singing of the birds, the rattle of the street-cars, the bright sunshine, and the marbles in their pockets. We wish the pupil, for the time being, to be entirely absorbed in one thing. That is good training in observation, but few teachers would call such occupation an observation lesson. They think of observation lessons only in connection with flowers, trees, animals, birds' nests, and other material realities. The usual directions for observing would lead to dissipation of attention—"scatteration"—rather than concentration.

Institute conductors used to talk much about training the observation. Frequently they asked such questions as "How many upper teeth has a cow? On which side of the cow's horns are the ears? When a cow lies down does she get down with her fore feet or hind feet first?" The same question was asked about the horse. "How many steps in the stairs coming into the building?" In country institutes the teachers could seldom answer the questions concerning the farm animals and after the conductor discoursed learnedly (at least at great length) upon training the observation and the teachers' poorly developed powers of observation, the teachers, who had lived all their lives among farm scenes, felt much chagrined and very green. Had some of the institute members politely requested the conductor to describe the lining of his coat or his hat, to tell the number of buttons on his coat, the colors of his neck-tie, the length of his shoes, the number of eyelets in his shoes, whether his shoe tips were plain or foxed, the number of windows in his house, etc., it would then have been a time for exultation on the part of the rustics and of chagrin on the part of the professor.

Effects Special, Rather than General.—Training in observation is special in its effects rather than general. It has been currently taught that training to observe in one direction or in one field will make one a more skilled observer in all others, but this view is coming to be discredited. Training in observing zoological specimens, for example, will not give increased skill in observing music or spring fashions. If you were to meet two

acquaintances on the street, the one a skilled botanist and the other an uneducated person, the latter would be more apt to see you than your biological friend. Now, it must be conceded that the biologist is, in general, the more skilled observer, although the unlettered person does just what some pedagogues advise for the cultivation of the powers of observation, *i. e.*, he sees *everything* about him. But in reality he sees *nothing*, that is, he sees nothing well. Seeing, as explained above, is a *mental* act and is not true seeing at all when the act ends with the identification of a retinal image. Dr. Harris says that "The acute seeing of the hawk or greyhound does not lead to a scientific knowledge, and persons with excellent seeing and hearing capacity in general, but without scientific training, are always poor observers. More than this, an education in science, although it fits a person to observe in the line of his own specialty, does not fit him to observe in the line of another science which he has not investigated. On the contrary, the training in one particular line rather tends to dull the general power of observation in other provinces of facts. The archæologist Winckelmann . . . could recognize a work of art by a small fragment of it, but it does not follow that he could observe a fish's scale and recognize the fish to which it belonged. On the other hand, Agassiz could recognize a fish from one of its scales, but could not, like Winckelmann, recognize a work of art from one of its fragments."[1]

Methods of Training in Observation.—From what has been said above, it will be seen that no special means for training are necessary. There is no class of objects nor group of subjects which form a monopoly for the training in observation. It is very evident that if we wish to become good observers in any direction we must observe much and carefully in that direction. We must "store" in the mind a vast fund of information which will form an "apperception mass" in the light of which the new material is to be observed.

All exercises or occupations that require close attention, careful discrimination of small differences, exhaustive comparison

[1] Preface to E. G. Howe's *Advanced Elementary Science*.

of factors, and identification of similarities contribute to the general qualities of good observation. Though the training in observation is special, yet the habits and tendencies of mind engendered by accurate observation in a given field, will undoubtedly contribute to the possibility of better observation in other lines. However, if one becomes proficient in one line it is no guaranty that he *will* observe everything in every other line entirely unrelated. It merely means that he may if he becomes interested in that direction and sets about to accumulate exhaustive acquaintanceship in that direction. It also follows that whatever exercise is attempted the complete and undivided attention should be given to it. An attempt should be made to marshal quickly and carefully all the related experiences that will enable one to obtain a clearer understanding of the object in hand.

Pupils need careful training in observing in each branch of study with which they deal. Geography and natural science have usually been thought of as affording special training in observation. Because they reveal the world of objects which have hitherto been unseen by children and thus enlarge their horizon they are very important and perhaps seem to have contributed exceptionally to the powers of observation. They undoubtedly have contributed to the range of the child's observation, but they have not contributed any more to the strength of attention nor to fineness of discrimination than Latin or any other foreign language would have done. The study of history may also contribute very largely to the power of discernment of fine differences of opinion. If studied comparatively, as it should be, it induces careful discrimination among facts. Geometry aids in visual discrimination, while all mathematics increases the discrimination among logical processes. The reading lessons demand careful attention to certain details and the detection of fine shades of differences. There is necessity for discrimination of letters and words, of various tones and modulations of the voice and the exact positions of the vocal organs in producing them. Then there are fine shades of meaning that require close

attention and a careful weighing of factors in order that they may be determined with exactness.

Thus we see that no subject can be shown to monopolize the opportunities for training in observation, but that any and all may contribute in special directions. Moreover, since all training is special it follows that in order to become an "all-round" observer, the training must be so comprehensive as to create a many-sided interest and to afford exercise in observation in many of the fields of human learning. It should be conceded probably that in early childhood when the child is in the presentative stage material things should be sought which offer the child tangible data for comparison. But it is a false doctrine of development which would maintain that sense-perceptions should constitute the sole psychic experiences of the child. Because the sensory centres are the best developed it does not follow that no abstract processes enter into the mental life. Early in life generic images or recepts form an important medium for thought. A stage higher and we have thinking by means of finer instruments—words; and at last conceptual thinking, carried on in so purely an abstract way that almost all traceable evidence of the symbols disappears beneath the threshold of consciousness. The child, therefore, needs for his proper development to be early exercised with things appealing to sense perception, and also to be trained to compare sense images with revived images. Not only should he compare perceptions and images, but also the recepts or generic images, which are perfectly familiar, and his concepts should be continually compared with each other. Now in this last process we have reasoning. Those who advocate excluding from the first school years all work demanding reasoning do not understand psychology. There are all degrees of reasoning from the simplest inferences of the dog (or of other lower animals) up to the complex abstractions evolved by a Kant or a Newton. Providing that the concepts with which the child deals are not too complex in their origin for him to grasp their significance the child will in no wise be injured by higher mental processes.

CHAPTER XVIII

NATURE OF IMAGINATION

Popular Meaning.—In popular parlance the term imagination is applied exclusively to those products of fancy akin to the air-castles of day-dreams and to certain illusions caused through fright or great exaltation of mind. Imaginative ideas are regarded by the unlettered as mere figments of the mind not corresponding to any existing or possible realities. By others the imagination is considered as dealing solely with the rearrangement of memory ideas, combining them into new, but as yet unexperienced, products. The loose definition "Memory is that faculty which represents things as they *were*, but imagination represents things as they *might be*," has dominated the thought of those untrained in psychology. Even many of the psychologists have dealt with the subject in the same very loose way. Teachers ask pupils to take imaginary journeys to distant lands to *see* the manifold things which a traveller to that country would be apt to see. They say they are training the imagination by this means. When questioned they reveal that they regard the *journey* as imaginative, probably because of annihilating so completely space and time and because so Jules Verne-like all natural laws are disregarded in the imaginary flight.

Again, teachers believe they are encouraging the imagination in the study of literature when they cause pupils to follow in thought some extravagant play of fancy or when they allow them to let their thoughts go unrestricted in depicting chaotic, impossible, and often inconsistent and senseless trains of ideas. The training of the imagination in each case is assumed to come through the transcendence of reality and through the wild play of ideas. As will be shown later, whatever training of the

imagination there may be in the "imaginary journeys" and the fairy tales comes from the vivid and accurate repicturing of things formerly actually perceived.

Scientific View.—A good many psychologists, while not unmindful that imagination is limited to the elements that have been experienced through sense-perception, still regard the imagination as exclusively a *combinative* power. While it is a *combinative* power, the essence of the faculty is its characteristic *reproductive* function. While the imagination may concern itself with the creation of air castles, its most fundamental form is the repicturing of objects which have actually been perceived through sense-perceptions. While the imagination may be of a type called *creative* the most elementary type is the *reproductive* imagination. The creative type is dependent upon the reproductive type and the difference between the two is but one of degree and does not involve fundamentally different psychical processes.

A sensation may be defined as the *simplest, undifferentiated, intellectual process or product arising from the stimulation of a sensory nerve.* In looking at a pencil you get a sensation of light, in touching it a sensation of contact, in lifting it a sensation of weight, and if you drop it on the floor a sensation of sound is aroused; perhaps you also receive a sensation of smell, and should you place it in the mouth you would receive a sensation of taste. Now, provided you are able to say that the sensations of light, sound, taste, smell, or weight come from some object you know and whose position you know with reference to yourself, you have a more complex psychical state than a sensation; you have a *percept.* That is, just as soon as it becomes differentiated from other sensations of the same modality you have some definite knowledge regarding the mental state and its cause. So we may define *perception* as *the process of localizing sensations and referring them to some external cause.* And similarly a percept is the complex product arising from the localizing of sensations and referring them to an external cause.

While the pencil was present to any of the senses the psychical

product was termed a percept. Look away from the pencil and you now have a picture of it. See if you can represent the sound of it as it fell to the floor; the weight of it as it lay in the hand; or the smell and taste of the cedar wood. See if you can recall definitely the appearance of a silver dollar. See if you can hear its ring as it is dropped on the table. These revived pictures of the sight, sound, taste, weight, etc., are not percepts, because the objects are not present to any of the senses. They are *copies* of the percepts; fainter and not so clear and vivid as the percepts. They are termed *images*. Hence the definition: *Images are copies of percepts*. And the process of imagination should then be defined as follows: *Imagination is the process of forming images*. Or, *it is the process of reviving percepts in the form of images*. Titchener says: "Imagination is imaging. And imaging a thing is thinking of it in kind: a tree is imaged by a visual idea, a piano note by an idea of hearing, running to catch a train by a tactual idea: the ideas are the same in kind as the perceptions which they represent. In this sense, a mind is more or less 'imaginative' according as it is better or worse constituted to think of things in kind: and the primitive mind—the mind whose ideas are photographic copies of perceptions—is the most imaginative of all." [1] And again he says: "The ideas of the primitive mind are, as it were, photographic copies, life likenesses, of the perceptions which go before them. Thus the idea of a landscape would be in part a picture-idea, the look of stream and hills and trees; in part a sound-idea, the idea of splashing water and rustling boughs; in part a tactual idea, the 'feel' of springing grass and moving wind; in part a smell-idea, a remembered freshness and fragrance of air and flowers. The life-likeness is, of course, never perfect; the idea is weaker, passes by more quickly, and is more sketchy, than the perception that corresponds to it: but the qualities of the perception are found again in the [imaged] idea." [2]

Illustrations.—Many persons think they imagine clearly, when, in fact, their imagery is very dull, or possibly lacking.

[1] *Primer of Psychology*, p. 201. [2] *Op. cit.*, p. 122.

Try to picture clearly through visual imagery your home when away from it; the school-house and the church you attended as a child. See if you can visualize your mother, your father, a distant friend. Which is clearer, the image of the persons as you have actually seen them or the image of some photograph of them? Why? The following is a capital test of visual imagery: Imagine a three-inch cube. Paint it blue. Imagine it cut into inch-cubes. How many cuts were necessary? How many cubes? How many cubes have no paint? How many have paint on one side only? How many have paint on two

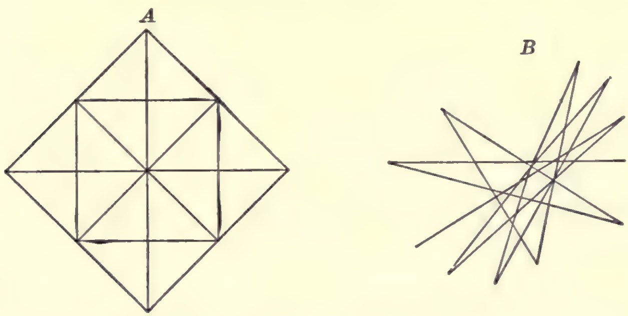

FIG. 33.—Tests for visual imagery.

sides only? On three sides only? On four sides? Draw from memory the picture of the print of a dog's foot as it appears in the snow or mud. Draw from memory a hen's track. Draw from memory your watch face. Look for a moment at some unfamiliar wall-paper or decoration and then turn away and see if you can describe it or draw it. Look for a moment at the accompanying irregular figure B, and then turn away and attempt to draw it.

Each of the two figures, A and B, has ten lines, but A can be drawn much easier than B because it can be analyzed and *remembered*. B must be *imagined* in order to be reproduced quickly.

Try to revive the exact sound of a friend's voice; the sound of the old school-bell; the music of "America" as sung by a

chorus, as played on a piano, on a violin, by an orchestra, or by a brass band. Revive the sensations produced by filing a saw, a step on the walk, or the splashing of water. If a product of imagination, each revival must be specific and concrete. It is not enough to know that we have heard the music, to feel that we could reproduce it, or to be sure that we should recognize it, if heard. It must be revived in consciousness so that it is a reproduction of what has actually been experienced in sense perception. To further test the power of imagery try to image the odor of violets, roses, onions, old books, new-mown hay, or a clover-field. How closely do the images approximate reality? Try to imagine the taste of pickles, coffee, roast beef. Without looking at the hand see if you can feel a glove upon it. Think of an ant crawling on the back of the neck, or a fly walking over the face. Do the images become so real as sometimes to become confused with actual sensations? How would it feel to bite a rusty nail, to touch a snake or a sand-bur?

The student who looks through the microscope, turns away, and draws accurately what he has seen must have a visual image in his mind of what he has seen. The more accurately he can represent the object, the more perfect his image. Many never portray well what they have seen because their imagery fades. They are sometimes unjustly accused of not seeing accurately. The child who makes an excursion to the field, forest, or quarry, and on returning revives pictures of what he has experienced is imaging, *i. e.*, is employing the imagination. To examine a hydrostatic press, a battery, a Wheatstone's bridge, a clam, a crystal, or a fern, and then to recall exactly what has been seen is to imagine. To listen to a note sounded by the director's tuning-fork and then hold it in mind long enough to sound the same is to imagine. To examine the color and texture of a piece of cloth and then go to the store without the sample and match it is to hold in mind an image—to imagine.

The musical composer must hear each note as it will sound, when executed. He must differentiate the various parts and hear each voice or each instrument as it will appear in the

rendition. In singing it is necessary to image the sound before it is produced. Thus a train of imagery runs in advance of the actual rendition. If a discord should be imaged for an instant that discord would be reproduced. This is just as certain as that when a bicyclist thinks of an obstacle he is certain to steer toward it. The image is held before the mind and largely determines execution. The architect who plans a building must see every part in imagination before he constructs his drawings. The carpenter who builds without a definite pattern-drawing must see each room, each door, each stairway, each pipe and fixture as they will be arranged, if mistakes are to be avoided. Try sometime to imagine a change in the stairway of your house, a change in the roof, or the furnace and note how definitely it must all be imaged.

Relations Between Memory and Imagination.—It will be necessary to distinguish between imagination and memory. As we shall more and more come to appreciate, mental life is a unity and not made up of entirely separate faculties or powers; hence memory and imagination will be found to be very closely related forms of mental life. We shall find, moreover, that they overlap each other. In their well-marked higher stages it will not be difficult to distinguish the two, but in indefinite stages they will be found to be indistinguishable. Distinguishing between memory and imagination, between sensation and perception, between intellect and will are much like making exacting distinctions between plants and animals. It is perfectly easy to determine to which kingdoms trees and horses belong, but when we come to sponges and the protozoans the task is more difficult and often even baffling. No one can say that a given sensation has no element of perception in it, nor in a given percept can one entirely separate the perceptional element from the sensational. The difference between memory and imagination can perhaps be better felt than expressed. In order to understand the differences each individual must experience them for himself. Certain hints may be given, however, to enable the learner to identify the states in his own consciousness.

We can image only individual ideas; not concepts. These latter can be remembered. Again, memory deals with the past only. Imagination deals with the past, present, or future. One may remember his yesterday's dinner. He may also imagine it. One may imagine the morrow's dinner, but he cannot remember it. He has not experienced it and cannot therefore recall it. Imagination is simply a special kind of recall—in the form of images. As above illustrated, if you can recall or produce in mind an idea of an object so definitely and vividly that it seems almost as if the object were present, then you have an image. If it is dim and hazy and indefinite you have a memory.

Dream Images and Illusions.—The best examples of imagery come to us in dreams. We see things, hear things, touch things, and even taste and smell things in such a concrete and vivid way that they seem real. For the time they are just as vivid as the actual experiences would be. Temporarily we are deceived into believing them real. Sometimes similar phenomena occur in normal waking life. We imagine that we see things, or hear sounds, such as voices, bells, or the clock-tick. We imagine that we feel things when there is no stimulation of the sense organs. Usually there may be a suggestive factor in some actual sensations, but the images that arise are very much stronger than the stimulation would warrant. Children, savages, and superstitious people are liable to have hallucinations upon the suggestion of the slightest stimuli. Darkness and lonesome places heighten the suggestibility. As De Quincey says: "Many children have a power of painting, as it were, upon the darkness all sorts of phantoms."

Insanity is little else than a species of disordered imagination. The abnormal mind, possibly through suggestion, sees visions, hears voices, and feels touches, which in a sane condition would not be experienced. The hallucination world in which the poor diseased mind lives is just as real to the one afflicted as the world of those unchanged by mental aberration. The self which the unfortunate peasant girl lives when her diseased brain deludes

her into believing herself Queen Victoria is no more a counterfeit and a pretence to her than the self we deal in when we go about thinking of our own supposed importance, or even when we deal in a more modest type of self. No two in normal life interpret the external signs of reality in the same way. The child obtains the same retinal pictures of the printed page or the written telegram as you and I do: but how different our interpretations! The telegram is a bit of bright yellow to be admired by the child or the savage. To you or me it may mean supreme joy or the depths of disconsolation and hopeless melancholy.

Imaging and Thinking.—One of the differences between memory and imagination is that concepts may be remembered but not imaged. We retain the concept and all the individual notions that it involves, but we cannot picture it as an image. If we image an ideal representation it is particular and not general. It is a generic image and not a concept. Some may experience difficulty in apprehending the distinction and therefore it will be considered in some detail. It may be asked in what form do we recall concepts and also how it is possible to think of anything without thinking of it in terms of images? But if one reflects, he will readily see that when he utters words or hears them in continuous discourse even though the words refer to some object of sense no image of it necessarily comes into consciousness. The possibility of halting and calling up the images which have been necessary in forming the concept is not denied. But all the particular ideas which have entered into the coalesced product seem to remain beneath the threshold of consciousness. The words representing ideas thoroughly understood are accepted by the mind as signs, and because of the "at-home-ness" of feeling they are passed by without calling up their detailed accompaniments.

The lower animals, undoubtedly, do all their thinking in sensory images or at best in generic images. These generic images may be likened to a composite photograph. Such a general notion is in the form of a sensory image which embodies the elements of each of the individuals which have appeared to

be most prominent. They are not necessarily the features most essential in scientific classification. Those would be the ones included in a clarified concept. The generic image, though an ideal representation, is a copy of a combination of percepts and is experienced in terms of some of the senses. The general notion never appears in consciousness in this form. Moreover, many of the revivals of individual notions never rise to the dignity of a clear image. They are vague, shadowy, and hazy. If the perceptions have been clear and vivid, revivals have been made possible, but it is not necessary that the image be brought into the focus of consciousness. What has been thoroughly cognized we readily recognize by the slightest symbol, just as when fully acquainted with a person the merest glance of a portion of the countenance, some garment, the sound of the voice, or the walk are sufficient to make us say mentally, "Yes, I recognize, I apprehend completely." Now we do not think of all the characteristics one by one, and we do not think of the person in all his varying moods, nor under all the circumstances in which we have seen him. These we feel confident of being able to picture if necessary. But there is an "at-home-ness" in the mental mood, which removes the necessity for further detailed picturing. This is a case of what is termed by Stout "implicit apprehension" of the meaning of words. He says that "The mental state which we call *understanding the meaning of a word* need not involve any distinction of the multiplicity of parts belonging to the object signified by it. To bring this multiplicity before consciousness in its fulness and particularity would involve the imaging of objects with their sensory qualities, visual, auditory, tactual, etc. But it has often been pointed out that in ordinary discourse the understanding of the import of a word is something quite distinct from having a mental image suggested by the word." [1] And in the same connection he writes: "It is certainly possible to think of a whole in its unity and distinctness without discerning all or even any of its component details."

[1] *Analytic Psychology*, I, p. 79.

The same facts were long ago pointed out by Burke, who erroneously concluded that there arises in the mind no idea of the things represented by the words—merely sounds "without any annexed notions." He says further: "Nobody, I believe, immediately on hearing the sounds, virtue, liberty, or honor, conceives any precise notions of the particular modes of action and thinking . . . for which these words are substituted. . . . I am of the opinion that the most general effect, even of these words, does not arise from their forming pictures of the several things they would represent in the imagination; because, on a very diligent examination of my own mind, and getting others to consider theirs, I do not find that once in twenty times any such picture is formed, and, when it is, there is most commonly a particular effort of the imagination for that purpose. . . . Indeed, it is impossible, in the rapidity and quick succession of words in conversation, to have ideas both of the sound of the word and of the thing represented." [1]

To those who have been used to believing that all their thinking is done in terms of sensory imagery, the question arises as to the form in which this imageless thought is carried on. The question is a very pertinent one. Each one can perhaps best feel the answer for himself. The process involved almost eludes description. But one who will carefully and persistently try to catch himself in the act of apprehending terms which are rapidly passed over will be satisfied that imageless apprehension is not impossible. Burke concluded that much of our thinking is imageless, but further erroneously concluded that we have no "notion" in our minds of the objects signified by the words. Such words are, he said, mere sounds. To this it cannot be agreed. The word is the sign by which we recognize that we have a background of knowledge which it is not necessary to call up in form of an image but which may be so called up at will. Nor is it necessary to call up all images and individual notions that have been involved in forming the concept. We must be able to distinguish a given notion from other objects or notions,

[1] Quoted by Stout, *op. cit.*, I, p. 81.

and, as Stout says, this power of distinguishing the apprehended object from other objects "is all that is necessarily implied in the imageless apprehension, which is sufficient to constitute the psychical state called *understanding the meaning of a word*." [1]

Lotze says: "When we have listened to a poem recited, to a melody sung, and forget the words and the tones, while yet all that was in them lives on in an abiding mood of our soul; when we first send our glance over the scattered details of a landscape, and then, after the definite outlines have long disappeared from our memory, still preserve an indelible impression, we make combination and fusion of the myriads of details into the whole of supersensible intuition; which we but reluctantly again analyze into its constituent parts in order to communicate it to others." [2]

The latest and best discussion of this phase of the subject is by Betts, who derives his conclusions from abundant experimental evidence rather than from *a priori* reasoning.[3] He believes that the amount of definite imagery in ordinary mental processes has been entirely overestimated. He rightly intimates that we need more investigation of *spontaneous* imagery. Most investigations of imagination have dealt with the *voluntary* types. Some of the conclusions can be given best in Betts's own words: "It is evident that most persons can command a far wider range and greater profusion of imagery than they normally employ. . . . The most efficient and successful thinking, at least of a logical and abstract nature, is with most persons accompanied by the least imagery. Thinking can and does go on without the intervention of imagery, the mental content being made up of feelings of meaning, relation, intention, effort, identity, interest, pleasure, displeasure, etc. Imagery may and often does serve as a familiar background for the meaning with which we are dealing,

[1] *Op. cit.*, I, p. 84.

[2] Lotze's *Microcosmus*, English translation, I, p. 635.

[3] "The Distribution and Functions of Mental Imagery," *Columbia University Contributions to Education*, No. 26.

but it cannot be said to be essential to meaning, except to the extent that meaning may inhere in a given percept *as such*, *e. g.*, the meaning of a beautiful sunset is chiefly this same *beautiful sunset*. . . . Very much of memory is accomplished without the use of imagery, and much of the imagery which accompanies memory is of no advantage to it. The 'memory image,' used as a general term to cover all memory stuff is a fiction." [1]

Nervous Processes and Imagination.—It has been shown that images may be so vividly revived or produced as to create illusions. We are sometimes deceived into believing that such experiences are perceptions of the objective realities. So strongly do the mental states resemble the perceptions of the same thing that we may experience fatigue from their continuance. This occurs in dreams where we believe that we are actively exerting ourselves; as in running, lifting, resisting, and the like. Sometimes we awaken completely exhausted by the apparent activity, when in actuality we have not stirred. We may produce the illusions of motor activity and its attendant fatigue in the classical illustration of crooking the finger as if to fire a pistol, while in reality not moving a muscle. Now, the explanation of all this is that it is the process of innervation that exhausts, not the actual muscular labor. As a matter of fact, in work it is not the muscle which becomes fatigued but the brain centre controlling it. In hypnotism a patient is made to believe, for example, that he has been burned. He feels the pain exactly as if it were real. More wonderful still the blister sometimes actually forms. This means that centres which control the blood supply have become so thoroughly affected as to change the amount of nutrition to that part. The explanation why no blood follows the thrust of a hat pin through the cheek or the hand in certain hypnotic performances is also not far to seek. All this indicates that the same processes which are excited peripherally, as the seeing, hearing, burning, etc., in normal perception, are in imagination set up internally. There can be no doubt that

[1] The reader should also consult Woodworth, "Imageless Thought," *Journal of Philosophy, Psychology and Scientific Method*, vol. III.

in imagination exactly the same sort of neural transformations occur as in sensation. The only difference is in their origin. There is nothing strange about all this if we recall what was said in connection with habit, association, and memory. Any change once initiated in the nervous system tends to persist and on the recurrence of adequate stimuli tends to function in precisely the same way as in the original stimulation. The doctrine of association has sufficiently demonstrated that adequate stimuli may come from a train of thought to set up other trains of thought. Every one, even untrained in psycho-physics, will tell you that one idea suggests another. Now why may not one functional brain process stimulate another functional brain process? This must be accepted if we acknowledge the facts of the physiological basis of association and the doctrine of psycho-physical parallelism.

The effect upon the nervous system of reproducing ideas in imagination is of the same kind as in perception with the object acting as a stimulus, the only difference being that in normal life a more intense activity is usually caused by perception than by an imagination of the same object. According to Bain, in imagination "the renewed feeling [state] occupies the very same parts, and in the same manner, as the original feeling, and no other parts nor in any other assignable manner." [1] Ribot, in commenting upon this, writes: "To give a striking example: experiment shows that the persistent idea of a brilliant color fatigues the optic nerve. We know that the perception of a colored object is often followed by a consecutive sensation which shows us the object with the same outline, but in a complementary color. It may be the same in the memory. It leaves, although with less intensity, a consecutive image. If with closed eyes we keep before the imagination a bright-colored figure for a long time, and then suddenly open the eyes upon a white surface, we may see for an instant the imaginary object with a complementary color. This fact, noted by Wundt, from whom we borrow it, proves that the nervous process is the same in both

[1] *The Senses and the Intellect*, p. 358.

cases—in perception and in remembrance." [1] While James believes that cases are rarities in which the sense organ is affected through the imagination, yet he admits that the imagination-process can pass over into the sensation-process and that the former differs from the latter by its intensity rather than by the regions affected.

"Jendrássik and Krafft-Ebing obtained marks like burns on their subjects by means of suggestion. If some object, such as a match-box, a pair of scissors, a snuff-box, a linen-stamp, etc., was pressed upon the skin, and the subject was at the same time told that the skin was being burned, a blister in the form of the object resulted. The marks remained a long time visible. . . . Burns caused by suggestion have often been observed in the Salpêtrière." Bleeding of the nose and of the skin was also caused by suggestion. "When the skin had been rubbed with a blunt instrument in order to give point to the suggestion, bleeding of the skin is said to have appeared at command, the traces of which were visible three months later." Delboeuf and others experimented in producing burns. In addition he made one of the wounds painless by suggestion. "It was observed in this case that the painless wound showed much greater tendency to heal, and, in particular, that the inflammation showed no tendency to spread." Mantegazza claims that he has been able to "induce local reddening of the skin simply by thinking intently of the spot." [2] "Charming" away warts and other affections then seem entirely possible under extreme conditions. It is not the hocus-pocus of tying up nine pebbles, placing them in a linen sack, swinging the sack five times to the left, and then four times to the right, around the head, and finally throwing the sack on a thorn bush that takes away the wart. But it is entirely possible that the thought concentrated upon the warty region may have affected the blood supply to that part and thus reduced the wart.

Children's Imagination.—Children are very imaginative. They live in a world of imagery and fancy. In the early period

[1] *Diseases of Memory*, p. 20. [2] Moll, *Hypnotism*, pp. 131, 132, 134, 306.

of their lives their thinking is carried on by means of images as instruments of thought. This is especially true of the pre-linguistic age. With the acquisition of speech the processes of generalized or conceptual thinking, previously effected through generic images, are now accomplished through the instrumentality of words and abstract symbols. But throughout childhood, while sense-perceptions are relatively stronger than any other process, all forms of sense-imagery are very vivid. So vivid are the child's imaginations, and so little reflective is he, that illusions are easily created. The child is extremely suggestible, *i. e.*, he easily seizes upon the merest sign and through his vivid imagery builds up creations which would not appear to the more mature. Careful studies have been made on the suggestibility of children. It has been found that children can be caused to imagine that they see things, hear things, smell, taste, and touch things that have no objective existence. The word or some sign is sufficient to arouse the brain centre controlling the particular function.[1] The degree of suggestibility is greatest in the first grade and decreases with age. That is, imaginative products are much more often mistaken for real perceptions in early childhood than in later life.

The vividness of visual imagery decreases after early childhood is past up to the age of maturity. To quote Sir Francis Galton: "The power of visualizing is higher in the female sex than in the male, and is somewhat, but not much, higher in public-school boys than in men. After maturity is reached the further advance of age does not seem to dull the faculty, but rather the reverse, judging from numerous statements to that effect; but advancing years are sometimes accompanied by a growing habit of hard abstract thinking, and in these cases—not uncommon among those whom I have questioned—the faculty undoubtedly becomes impaired. There is reason to believe that it is very high in very young children, who seem to spend years of difficulty in distinguishing between the subjective and objective world. Language and book-learning certainly tend to

[1] Small, "Suggestibility of Children," *Pedagogical Seminary*, 4 : 176–220.

dull it." [1] There is reason to believe that the power of visual imagery becomes less vivid with advancing years and growing intellectuality because of disuse of that particular kind of thought-instrument. Better modes of thinking are acquired and the slow, cumbersome, old process is short-circuited. We have no statistics to show that images derived through the other senses become less distinct with advancing years. But probably a similar change occurs in hearing. Auditory images become less necessary as conveyancers of thought with progress in language and abstract thinking.

This child-world is not a product of creative imagination, but one of reproductive imagination. Through imitation the child reproduces the world which he sees about him. His cosmos is a reflection of the experiences he has been able to drink in. I have no evidence that there are great flights of fancy in which unexperienced scenes and situations are marshalled together. The child plays with dolls and although these, often crude objects, are imaginatively made instinct with life, yet the child does with them and has them do only what she has seen her mother or the nurse do with the baby. The little mischiefs play school and in so doing impersonate different individuals. One assumes the rôle of teacher while the others are pupils. The play-pupils (imitatively) sit obedient to the dictates of the teacher with now and then an (imitative) infraction of the rules. They are punished in an approved (imitative) fashion, *i. e.*, in the fashion set by the real teacher of their acquaintance. They seldom assume rôles not imitative. Sully says that the "impulse to invent imaginary surroundings" is very common. In fact, he denominates all plays which are dominated by the imagination as creative or inventive. Through my own personal observations I am not able to confirm this position. Moreover, I have failed to find in all of Sully's or Baldwin's examples of imagination any that give evidence of much, if any, inventiveness on the part of the children. In childish lies we have some invention for the purpose of avoiding consequences, but during play the child is

[1] Galton, *Inquiries into Human Faculty*, p. 99.

attempting to mirror truthfully the world as he understands it. To be sure, the child builds perfect products from the crudest materials; a stick or a chair or his own body seem equally well adapted to be transformed into a dashing steed. There are no obstacles between the raw material and the flawless product. His inventive powers are little taxed in the transformation. He pictures a desired end and presto! it is secured.

In playing with her dolls the little girl, though living a life which she knows is make-believe, is a faithful imitator of the mother or nurse. A little mother of four summers was heard to say: "Oh mercy! baby must have a clean dress on; but all are in the wash. Does you want your cloak on, too?" When a child harnesses the chairs, calls them horses, and makes himself the driver, he imitates very closely the actions of the real driver, whom he has seen. A child who has never seen equestrians will never ride an imaginary broomstick horse. A boy whose father had a lariat and used it in lassoing horses was continually seen with a noosed rope playing at the capture of animals.

Because of the vivid manner in which children image things, a caution needs to be given against telling the child things which will be magnified into terrorizing objects. All stories of the bad man, the bogie, big bear that will catch you, wolves, tramps, robbers, future punishment, etc., should be scrupulously avoided. Many children are made timid and retiring throughout life because of injudicious stories of bogie-men, spooks, etc. If the child could understand that they are fictions he would not be so troubled, but imagination becomes belief and often a belief haunts one as a life-long spectre. In this connection proper caution should be observed in telling children, even about such harmless and well-disposed genii as Kris Kringle or Santa Claus. The good fairies and Santa Claus should never be represented to be dwelling too near, as for example in the chimney or behind the house or under the bed. Let them be the good men, away off. I have seen my child G. come to me all agitated, trembling, and apparently in great mental agony because a servant told her

that Santa Claus was in the kitchen chimney. She was not a skittish child, had never been afraid of the dark, and had never been frightened by being told of bogie-men and spooks. The child only too readily peoples with imaginary creatures all dark corners and the space behind and beyond things. One writer says: "When I was a child and we played hide and seek in the barn, I always felt that there must or might be behind every bundle of straw, and especially in the corners, something unheard of lying hidden."

Children are very animistic and often, like the savage, imagine inanimate nature endowed with life. The savage heard the voice of nature talk to him with tongues understood only by the primitive mind; the child recapitulating the race history understands those same voices. The poet, like the child and the savage, penetrates what is invisible to ordinary mortals, and is cognizant of the same unseen powers. These he discloses to us through his versifications. To the ordinary mind these voices become hushed through the complex of psychic influences necessary to mature existence. A careful canvass of many children's ideas concerning streams and bodies of water secured thousands of replies in the same strain as the accompanying: F., 12:[1] "I think of water as a person; it seems as if it could talk." F., 15: "The ocean seems as if it had life like a roaring lion." F., 13: "The ocean always seems to be planning some wrong." F., 5½: Was sailing a boat; the string broke and the boat went sailing away. She said: "Water, if you don't bring back that boat I'll tell mamma." Another time she was heard to say to the brook: "I wonder where you go to? Do you ever get tired? I know I should." F.: "I used to think the river had life, but different from ours; it was always a puzzle to me." F., 17: "I used to imagine the water had life; I knew that it really hadn't, but I liked to think it had and that it was like a person." F., 18: "When a child I frequently thought the brook had life and was talking as it rippled over its stony bed." F., 30: "I am happier in the instinctive feeling that

[1] F = female. M = male.

water has a kinship of life with me, than when I am under the domination of reason concerning such things."

Jean Ingelow confirms in her own experience my investigations. When about two or three years old "I had the habit," she writes,[1] "of attributing intelligence not only to all living creatures, the same amount and kind of intelligence that I had myself, but even to stones and manufactured articles. I used to feel how dull it must be for the pebbles in the causeway to be obliged to lie still and only see what was round about. When I walked out with a little basket for putting flowers in I used sometimes to pick up a pebble or two and carry them on to have a change; then at the farthest point of the walk turn them out, not doubting that they would be pleased to have a new view." Sully says that through imagination "the child sees what we regard as lifeless and soulless, as alive and conscious. Thus he gives not only body but soul to the wind when it whistles or howls at night. The most unpromising things come in for this warming, vitalizing touch of the child's fancy. . . . Thus one little fellow aged one year and eight months conceived a special fondness for the letter W, addressing it thus: 'Dear old boy W.'"[2]

Imagination and Belief.—It is perfectly possible that in the savage imagination may pass over into belief. Apparitions which arise through superstitions may be as real to him as any existent realities. But he is led to the belief through superstitious faith in authority rather than from sense illusions. The belief causes the illusory images rather than vice versa. These fanciful creations then arise at the merest suggestion because the ideas do not antagonize the comparatively simple mental system. They readily accept the authority of superstition and personify inanimate objects, believe in incantations, sorcery, etc. But it is largely because of the great weight of a mass of tradition. In the same way children who are so imaginative may easily accept superstitions and come even to confound fantasy

[1] "The History of Infancy," *Longman's Magazine*, Feb., 1890.
[2] *Studies of Childhood*, p. 30.

with reality. If children continually are told fairy stories as facts, and superstitions are doled out as realities, they may be easily led to confound fact and fiction. But if fairy stories are told as fairy stories and children are always dealt with honestly, they have little tendency to self-deception concerning the play of their fancy. It need not be feared that children's enjoyment is a whit curtailed by treating their fairy stories as fictitious creations. They often design the most fantastic creations and play the leading rôle in the drama, and when they notice that they are being watched in a quizzical way they suddenly burst out laughing and implore you not to observe them. You desist and the play is resumed. They are merely acting and they realize it perhaps as fully as any comedian or tragedian. Although a good actor works up to a great degree the mental states he assumes no one in impersonation ever lost his identity and did things or believed things out of harmony with his real self.[1] Their belief of the things to be imagined does not enter in as a factor. As Stout puts the case: "To imagine is simply to think of an object, without believing, disbelieving, or doubting its existence." [2]

If the creations of imagination are real to the child, why does he allow the same objective stimuli to suggest such kaleidoscopic scenes? One minute his blocks are called a house, the next a steam engine, again a fence, and still again in the same brief play period a hospital,[3] and at any moment only blocks. Why is the doll so neglected if it is thought to be a reality? The real baby is not accorded doll-treatment. The little maid of five years, through a sense of responsibility in the trust confided to her by the care of her little baby brother, will not leave him, but throws her dolly to the floor at any moment and runs to play with something momentarily more attractive. My little girl of five came in one day and cried because her younger brother would not let her doll sleep. I said, "Can your doll hear?"

[1] Long-continued belief, even in imaginary ideas, undoubtedly greatly affects the individual, as will be shown in the chapter on the emotions.

[2] *Analytic Psychology*, II, p. 260.

[3] I witnessed such a rapid transformation just before writing this.

"No, but I play it can," she promptly replied. It seems to me that her complaint was because he was disturbing the harmony of the imagined situation and spoiling her pleasure. In play the mind seeks to contemplate only that which excites pleasurable emotions. It rigorously rejects everything inharmonious with the pleasurable situations. In day-dreams we do the same thing. We studiously avoid harboring anything disagreeable. At the same time we are cognizant that the imagery is merely a dream. In sleep we often do the same thing. It is not probable that the child has a firm belief that the objects of nature are animate. It is merely a play of the imagination which carries the child into a suprasensuous world and produces a *quasi* illusion which causes him to make believe that life-like qualities exist. It is merely a personification which in exceedingly strong imaginative natures causes the apparent likeness to approximate the reality experienced in the dream state. It may be that in children the dream state is regarded as a real experience, but in adults the dream state even at the time is frequently known to be only a dream. Of course, one can very easily convert the imagination into beliefs. This is the case with the thought of the bogie-man and many ideas that we call superstitions. Ghost stories readily create a firm belief in ghosts. Many people undoubtedly see ghosts as really as they see the house in which they live.

Limitations of the Imagination.—The imagination is limited to the use of materials already in the mind. Sense-perception must furnish the elements, the raw material, out of which the imaginative product is produced. This is true in the case of the highest creative imagination, as well as in the lowest form of mechanical combination. It may be stated as a law that *no product can be imagined, the elements of which have not been experienced in sense-perception.* The congenitally blind cannot imagine color, nor the congenitally deaf imagine sound. Among the blind it has been found that those who become blind before the age of six or seven never dream of colors, while those deprived of sight at a later age frequently have dreams in which

color is a factor. The necessity for sense-elements out of which to construct the new picture is well illustrated in the case of Sir Walter Scott, a writer of the most vivid imagination. In a visit to Mr. Morritt, Scott said to his host with reference to some facts which he had given to Scott: "You have given me materials for romance: now I want a good robber's cave, and an old church of the right sort." "We rode out," says Mr. Morritt, "and he found what he wanted in the ancient slate quarries of Brignal and the ruined abbey of Eggleston. I observed him noting down even the peculiar little wild flowers and herbs that accidentally grew round and on the side of a bold crag near his intended cave of Guy Denzil; and could not help saying that, as he was not to be on oath in his work, daisies, violets, and primroses would be as poetical as any of the humbler plants he was examining. I laughed, in short, at his scrupulousness; but I understood him when he replied, that in nature herself no two scenes were exactly alike, and that whoever copied truly what was before his eyes, would possess the same variety in his descriptions, and exhibit apparently an imagination as boundless as the range of nature in the scenes he recorded; whereas whoever trusted to [constructive and not accurate, reproductive] imagination would soon find his own mind circumscribed, and contracted to a few favorite images, and the repetition of these would sooner or later produce that very monotony and barrenness, which had always haunted descriptive poetry in the hands of any but the patient worshippers of truth." [1]

The foregoing also illustrates the fact that in the best imaginative literature, the finest descriptions contain more of truth than of fiction. The salient characteristics which have been selected for the scene characterized must be true to life. It is said that Scott's characters "are felt by those who are well acquainted with the Scottish life of the past to be so intensely *natural* that every one of them *might* have been a real character. And the same is true of the best of Dickens's and of Thackeray's imaginary constructions, in which these great humorists have so

[1] Carpenter, *Mental Physiology*, p. 492.

completely identified themselves, as it were, with the several types they delineated, as to make each of them speak and act as he (or she) would have done in actual life. It is certain, indeed, that most of these (as in Walter Scott's case) are developments of actual types; while those which are purely *ideal*—the work of the *creative* rather than of the *constructive* imagination—lack 'flesh and blood' reality." [1] Burroughs wrote of Tennyson: "A lady told me that she was once walking with him in the fields when they came to a spring that bubbled up through shifting sands in a very pretty manner, and Tennyson, in order to see exactly how the spring behaved, got down on his hands and knees and peered a long time into the water. The incident is worth repeating, as showing how intently a great poet studies nature." After knowing these habits of the great poet we can readily understand why he could pen such an exact simile in the lines:

> ". . . arms on which the standing muscle sloped,
> As slopes a wild brook o'er a little stone,
> Running too vehemently to break upon it."

Individual Differences in Imagination.—There are manifestly very great individual differences in the power of imaging. Some persons possess a good imagination for all classes of sense-percepts, others possess remarkable powers in a certain class, as sight, and still others are almost devoid of any powers of vivid imagery. The classic investigations of Sir Francis Galton for the first time revealed these striking individual differences in mental processes. The fact that people are incredulous about such differences is a strange thing. That such mental differences exist is no more strange than that some people are tall, some short, or some red-haired and some black-haired. But the popular mind is slow to recognize that mind is the greatest variable in existence. Galton asked a very large number of persons to study their imagery by the following test: "Think of some definite object—suppose it is your breakfast-table as

[1] Carpenter, *op. cit.*, p. 502.

you sat down to it this morning—and consider carefully the picture that rises before your mind's eye.

"(1) *Illumination.*—Is the image dim or fairly clear? Is its brightness comparable to that of the actual scene?

"(2) *Definition.*—Are all the objects pretty well defined at the same time, or is the place of sharpest definition at any one moment more contracted than it is in a real scene?

"(3) *Coloring.*—Are the colors of the china, of the toast, bread-crust, mustard, meat, parsley, or whatever may have been on the table, quite distinct and natural?"

He says that the first results of his inquiry amazed him. Some protested that mental imagery was entirely unknown to them; others habitually possessed imagery full of distinctness, detail, and color. Scientific men seemed to have much less vivid and exact imagery than the unscholarly. Later researches have disclosed great differences among different individuals, and also that a given individual may have some type much better developed than others. It is probable that mature individuals and scholars have not lost their powers of imagination, but that they utilize higher modes of thinking than children and the untrained. The former could, if necessary, think by means of the more primitive method—through imagery.[1]

[1] Galton, *Inquiries into Human Faculty*, pp. 83–114. The reader should also consult Bentley, "The Memory Image," *American Journal of Psychology*, vol. XI; Lay, *Mental Imagery;* Pillsbury, "Meaning and Image," *Psychological Review*, vol. XV; Betts and Woodworth, previously cited. These, with the special references cited throughout the text, will be a sufficient guide to the literature of the various phases of the subject.

CHAPTER XIX

IMAGINATION AND EDUCATION

General Considerations.—A person with a well-developed imagination can repicture clearly, vividly, and accurately a great variety of perceptions which have been gained through personal experiences. He also has the ability to recombine his imagery so as to construct new pictures out of the elements of the reproductive images. A well-trained power of imagination enables the possessor in addition to hold voluntarily before the mind any selected images and to exclude others. Through voluntary selection the trained individual is able to reproduce his imagery for advantageous consideration and to recombine elements into logical, consistent trains of imagery and thus lead to the construction of new and original combinations.

The child usually possesses vivid imagery, but the images lack accuracy. The child also lacks voluntary control of his images and trains of thought. Consequently, the child's fancy is flitting, incoherent, inconsistent, and ineffective. The child thinks out very fanciful stories, but they would hardly make a consistent piece of fiction. It is only with effort and through training that the adult is able to control thoroughly his imagination. It is erroneous to regard the child's imagination as being better or stronger than that of the adult. The unbridled play of fancy in the child causes his ideas to run riot, and as imagination is so frequently made identical with fancy, his imagination has come to be regarded as stronger than that of the adult. The great activity and vividness of the child's imagination coupled with the fact that every imagined product deepens impressions on the brain and the mind in precisely the same way that original perceptions do, suggests that this power should

contribute much in the education of the child. Not only may intellectual lessons be reinforced, but we may emphasize if not actually create moral tendencies by stimulating the child's imagination in right directions. Just as bodily health or disease may be induced through the imagination, may we not induce mental health or disease by imaginative stimulation? Ideas held before the mind tend to result in the corresponding activities, hence the desirability of holding only correct ideas and ideals before the mind. Harboring immoral imaginations will tend to convert them into beliefs, and we *are* to a large extent what we believe.

What Training Involves.—Training the imagination may concern itself with either increasing the power of vivid recall or with control of the train of imagery, directing it into desired channels and thus leading toward the creation of new and original combinations. From the discussion of the psychological meaning of the imagination it can readily be inferred that the key to its training lies in the proper development of sense-perception. To state it formally, there are requisite: (1) Opportunity for abundant sensory experiences; (2) Judicious guidance and direction along proper channels; (3) Sufficient exercise in reviving actual experiences; (4) Practice in building accurately imaginary pictures painted by another, as in literature, geographical descriptions, etc.; (5) Attempts at constructive imagination.

Recognition of Individual Differences.—In view of the fact that there are great individual differences in the power of imagery, the question arises whether we should attempt to develop the special talents or supply deficiencies and try to secure equal powers in all directions? Three types of imagination undoubtedly have become of greatest importance in our lives. These are the visual, the auditory, and the tactile; and an attempt should be made to secure at least a medium degree of proficiency in reproducing each of these classes of images. The senses of taste and smell are not so absolutely essential, but, however, unless the sense organs are defective they should receive training,

as the pleasures of life may be much enhanced by being able to recall images in terms of these senses.

These individual differences in imagination should be recognized in education. The kind of imagination one possesses often determines his success in a given subject of study or in a given occupation in life. The type of imagination possessed by a pupil may also determine his method of studying particular subjects. One child learns spelling best by visualizing, another by audilizing, another by reproducing the ideas in motor terms. One learns best what he reads by reproducing it visually, another by reviving the sound, another by feeling the action of the vocal cords or the muscles involved. I know of two children who are taking piano lessons. One of them can play from memory without the notes anything once mastered; the other must always have the written music or she cannot reproduce any of the lessons. The first has good auditory imagery, the other is very lacking in this type but depends upon visual and motor imagery. Some people are wofully lacking in the power of visualization. Such persons cannot draw, could not become good architects or designers, can invent nothing, and probably could not build anything so that the joints and parts would fit. They could not make a success of real geometry study. They might memorize demonstrations but could not fully comprehend them. It frequently happens that a boy is a great success in algebraic mathematics and an equal failure in geometric mathematics. Success in the latter demands a high type of visualizing power. Similarly many boys bright in geometry, drawing, and natural science may make signal failures in their music. To achieve success in music requires especial powers of auditory imagery. Successful designers of wall-paper, carpet patterns, furniture, textile patterns, and decorations; fresco painters, milliners, dressmakers, tailors, architects, and inventors, must all have good powers of visual imagery. One who possesses special powers of visual imagery should seek an occupation giving opportunity for their employment.

The possessor of a notably vivid auditory imagination should

turn to music, language, or some occupation demanding fine powers of auditory discrimination. No one has ever become a skilled vocal linguist without possessing ability to detect fine shades of sound differences and the power of accurate revival through imagery. The great musical composer must hear in auditory imagination every instrument, every voice, and every note to be produced before he can really compose the new production. Mosso says: "An able dramatic writer once told me that when he composes he has to shut himself up in his study because he is obliged to make his characters continually talk aloud. He receives them as if on the stage, shakes hands with them, offers them a chair, follows them in every little gesture, laughs or cries with them as occasion demands. When he writes he always hears the voices of his actors." The possession of vivid tactile imagery is rare—certainly in adults. Frequently it is developed in the blind because of the lack of visual imagery. To be able to revive tactile perceptions accurately is a gift as valuable as rare. The great surgeon owes his skill largely to this power. Artistic skill in drawing, painting, or sculpture depends much on tactile imagery.

How to control properly the imagination is a question second in importance to no other in the realm of intellectual training. "Here in a child's imaginings," says Dr. Burnham, "is a vast fund of spontaneous interest. How to utilize it; how to check imagination when extreme without wasting this spontaneous interest; how to develop imagination when deficient—in a word, how to adapt education to individual differences in productive imagination—such are the teacher's problems. . . . There is infinite variety in the talents and in the deficiencies of human beings. Teachers must study the individual differences in their pupils. . . . Careful study of the effect of different methods might show that no method has ever been employed that had not some good in it for some individual; but it would also show that no method (except in its general principles) is of universal application." [1]

[1] *Pedagogical Seminary*, 2 : 224.

Importance of Varied Development of Imagination.—It is very important that children have opportunity for exercising the various types of imagination. If only one type is appealed to a habit of depending upon that type is developed. This may lead to inefficiency in various kinds of activities. It may also produce one-sidedness of mental development, because excessive stimulation will produce hypertrophy in one direction and the lack of exercise will lead to atrophy in others. The varied life activities demand imaginative power of many kinds, and the individual lacking in any one phase of development is debarred from efficient participation in certain activities. If lacking in imaginative insight in many directions he will be seriously handicapped in life's race. Even in school the pupil who depends upon a limited range of imagination appears to be unresourceful and lacking in success. To enjoy life through the imagination the types must be varied. A single type of imagery continuously experienced becomes monotonous. We should be able to enjoy music, painting, landscapes, literary art, scientific imagery, the practical arts, etc. The school should afford a wide range of imaginative exercises so as to give power of enjoyment; to give efficiency in dealing with life's problems; and to help in discovering special talents which pupils may possess. There is no more inviting and promising field of educational psychology at present than that of the study of types of mental imagery. We need especially to know how to readily and surely discover the types of imagery possessed by given pupils.

Dangers from One-sided Development.—There are several dangers attendant upon a too highly specialized power of imagination. Pathological disturbances seem easily induced by over-specialization. A particular type of imagery may become so persistent and obtrusive as to produce insanity. The hallucinations are due to abnormal imagery, so vivid as to be believed as reality. The images pursue the patient during the insanity with the utmost persistence. Between complete insanity and normal life there are many stages of affliction from insist-

ent ideas. Some persons cannot climb to high altitudes without imagining themselves jumping off. The idea may persist and through the laws of ideo-motor action it may become an actuality. Many have been troubled by certain songs or tunes continually obtruding themselves in consciousness. These may be as harmless as "Annie Rooney," or "Wait Till the Clouds Roll By," or they may be more objectionable. Words and phrases may continually recur in consciousness and become very exasperating. Some words that one has accidentally caught persist with the most annoying pertinacity. Diseases are initiated or exaggerated through the imagination. Quacks seize upon this fact and distribute literature asking whether patients have not certain symptoms which are sure indications of an early grave. The unsophisticated readily begin to develop these symptoms and really become diseased. The influence of the imagination in alleviating diseases is well known to good physicians. A large percentage of ailments need no other medicine than cheerfulness and an imagination that the possessor is well or recovering.

Not all hallucinations are cases of exaggerated persistent *visual* imagery. Auditory images may be equally obtrusive. Among historical examples of auditory hallucinations are the demon of Socrates, Mahomet's celestial messenger, Luther's devil, and the voices inciting Joan of Arc. "Queyrat cites the case of a composer who had unusual auditory imagination. As he sat by his fire and recalled the song of a linnet that he had heard during a walk in the field, he heard a complete symphony—Beethoven's 'Pastorale.' Nothing was lacking, although at times the voices of nature mingled with the orchestra. But his marvellous imagination had exasperating caprices. Often for entire days some vulgar refrain of a hand-organ would keep repeating itself. There was no means of escaping from this obsession. Even sleep did not avail; and the more he exerted himself to shake it off, the more it clung to him."[1]

[1] Quoted by W. H. Burnham, *Pedagogical Seminary*, 2 : 219.

IMAGINATION IN THE FORMAL SCHOOL SUBJECTS

Imagination in Geography Study.—Geography has for a long time been denominated the subject *par excellence* for exercising the imaginative powers. Unfortunately the very phase which lends itself to the basal training of imagination has been overlooked. Because one can take imaginary journeys and through his mental flight annihilate space and time, because of the unbridled liberty given to the imagination in geographical thinking, this subject has acquired its reputation. The subject, properly taught, does employ the imagination, but not as popularly supposed. It is just because geography deals with objective realities—physical phenomena and human activities—that it deserves a high place as a realm for the exercise of the imagination. In a large measure it deals with things, the elements of which either have been personally perceived, or may be exhibited by objective or pictorial representation. This is not true of the subtle phases of history or literature, especially those aspects dealing with intellectual and emotional life. Although life should form the core of geographical instruction we are there concerned with its more outward characteristics: what people are doing; how they live; the houses they live in; their clothing, food, amusements, religion, schools, their art galleries, the scenery they enjoy, products, manufactures, interchange of goods, etc. Not a single one of these ideas but that is susceptible of pictorial representation, and not one but may be apperceived in terms of sense experiences obtainable in any good course in home-geography.

The primary desideratum in training the imagination through geographical instruction—or its correlate, geographical teaching through imagination—is adequate contact with sufficiently varied surroundings. Some writers rightly advocate a rich fund of experiences gleaned from rural life—a study of land and water forms, processes of land sculpture, plant and animal life, etc. They also constantly bewail the life of the city child. It is true that the city child who never gets into country surrroundings

suffers a fundamental lack in his experiences. He is debarred from enjoyment through imaginative contemplation of much that is suggested in his study of the sciences and literature. But, is there not an equal lack suffered by the country child through his deprivations from contact with life—human life—as aggregated in urban surroundings? We must acknowledge that the young child is fortunate if not too early stimulated by the complexities of metropolitan life; but at some time in the pupil's experiences he should witness some of the scenes of the modern city. When we consider that a large percentage of civilized people are congregated in the cities and that only in the cities is manufacturing engaged in, that in the cities evidences of the world's greatest achievements in science, art, education, and politics are to be found, then we must equally recognize that if a child studies geography in which life is the core around which all is grouped, he must have become, for a time at least, one of the great busy, bustling throng, there to see, hear, touch, feel, what people in that tumultuous crowd see, hear, touch, and feel. Otherwise, when he studies foreign life, because of the law of the limitation of the imagination he can in no way represent them as realities. For one, I commiserate the country youth who, when studying foreign geography, struggles with the complexities of city life which find no responsive chord in himself. The great metropolitan centres, with their shipping, their railroads, their museums, cathedrals, art galleries, and ceaseless hum of factories mean little to him unless he has seen and heard something akin to these with his own eyes and ears.

Everything possible should be done to secure objective illustration of as large a fund of facts as possible. Wherever practicable things should be seen in their natural habitat, plants in the fields, rocks in the ledges, etc. Excursions should be of frequent occurrence in all schools. The fresh air and exercise are themselves conducive to clear brains and vivid imaginations. Many city children have never seen common domestic farm animals such as the cow, pig, hen, and sheep. Their only ideas have been built up from pictures. Their ideas through this

source are often so erroneous that many children have thought the cow no larger than a mouse. The pictures were of the same size, why should they not so think? "Such children," writes Guillet,[1] "are being starved not only in one of their strongest interests, but also in language and ideas, for all languages are replete with metaphors, proverbs and other folk-lore which allude to animals and plants and which must therefore remain meaningless to them." Excursions should include factories, foundries, flouring mills, paper mills, tanneries, printing offices, brick-yards, stone quarries, water-works, gas-works, electric-lighting plants, railroad depots, commission houses, museums, art galleries, law-courts, legislative halls, caucuses, etc., the particular ones visited depending upon the locality. Not infrequently are classes taught about plants, soils, and minerals, without a single objective illustration, not seldom do pupils "pass" in the subject of civil government without ever having witnessed a single feature discussed. It is not unusual to have pupils study dynamos without any observation of a real dynamo. It is still words, words, words!

The school museum should also be a prominent feature of every school. In it should be found specimens of forest, field, factory, and trade from home surroundings, and as much as means will allow illustrating the life of other countries. Extended zoological, botanical, and mineralogical cabinets are not usually so educative for children as collections typifying the industrial and social life of people—remember that the people are to be the centre of interest. Children should be encouraged in their natural instinct for making collections. More geography has frequently been learned by a boy through his stamp collection—which his teachers and parents may have ridiculed and tried to destroy—than in all of his hours of formal toil at the subject. Of two hundred and twenty-nine boys, Dr. G. Stanley Hall found that only nineteen had no collections. Thirty-two per cent. of these had made collections from nature, and thirty-four per cent. had made postage-stamp collections. The age at which the

[1] *Pedagogical Seminary*, 7 : 432.

postage-stamp instinct is at its height seems to be from nine to eleven years of age—just the age when geography is one of the dominant school subjects.

In studying the geography of foreign countries we must make it concrete, even where not feasible to make it objective. The child should get many details so that the concepts may be full of meaning. Much should remain in his mind in the form of generic images. Even where the ideas are of the conceptual order there must be a possibility of "concreting" the abstract. In order to secure fulness and concreteness, the text-book will have to be abandoned, or at any rate considered as a *text*, with the *context* to be supplied. Most books are altogether too condensed. Here is a sample description of the people of Holland as given in a recent geography: "The Dutch are an exceedingly thrifty, hard-working people. They succeed in raising good crops of rye, wheat, oats, and other farm produce, and they export cattle, sheep, butter, and cheese." The whole consideration of Holland occupies less than a page, one-fourth of that space being given to two pictures—the best part of the whole description for children. But with the necessary generality of the statements what could remain in the child's mind except words? No imagery has been suggested because the discussion is concerned with giving superlatively condensed statements expressive of concepts. Now we have seen that concepts cannot be imaged. Only individual notions are capable of being imaged, and as no concrete notions have been given, we have then not real knowledge, for the concepts can only be constructed through the accumulation of particulars, but we have merely the symbols representing knowledge. The words in such cases correspond to the untranslated x in an equation.

In order to get a picture of Holland the pupils should see as many objects from there as are obtainable and at least see pictures of many other things illustrative of Holland life. In this picture there must be definite imagery of the historic windmills, its "misty-moisty" climate, the sluggish rivers, flat land—so flat that from a certain tower in Utrecht almost the entire country

can be seen; we must image the three great enemies of Holland, the lakes which they drain, the rivers which they imprison, and the great arch-enemy, the sea, which they combat, sometimes successfully, sometimes themselves overwhelmed; we must image the reclaimed acres and the dikes, which nobody has ever described perfectly in words; the alarm bells; the stage-boats on the canals in summer and the whole families from grandsire to grandchildren on skates in winter; the storks on the roofs, with the traditions which each little Hollander is told concerning these sacred birds; the Dutch fishing-boats, the awkward carts, the housewives scrubbing the floors; the wooden shoes with silver buckles, the short petticoats and gorgeous head-dresses; the Delft-ware and the naturalistic paintings of Rembrandt, van de Velde, and Ruysdael. These and scores of other objects and events must be brought before the pupil so vividly that he projects himself into the scene as an actual witness. This can be accomplished only by presenting many details and in a concrete way. It is only by this means that a proper conceptual idea can arise. To leave out of Dutch life the windmills, the dikes, the storks, and the habits of the people would be like teaching Hamlet with Hamlet left out. It is not impossible to teach all the above concretely, either by objects, pictures, or through verbal description which portrays the new scenes in terms of known experiences.

"Recently I went into a practice school connected with the University of Chicago," writes President Faunce, "where I saw the children gathered round a teacher who was reading to them the poem of Hiawatha, and their eyes were wide with wonder. Then they went over into the Field Columbian Museum and saw the materials of Indian life, the tents and the wampum, the feathers and the moccasins, and all the utensils of the Indian household. Then they returned and modelled in clay an Indian village, with Hiawatha at one end of it, and all over it the marks of the creative imagination." In contrast Dr. Faunce says: "I, too, learned Hiawatha, side by side with Mr. Colburn's ingenuities. I could spell the name of every tree in Hiawatha's

forest, but would not have known one of them if I had seen it. I could pronounce the name of every beast on the American continent or in Noah's ark, but knew nothing about any one of them." [1]

Collections of pictures should form a part of the equipment of every geographical class-room. Such collections as are found in many magazines and accompanied by verbal description can be easily obtained and they serve to awaken great interest and to make things real. Photographs can frequently be secured. The stereopticon views are still better. One only needs to watch the crowds going to the "magic-lantern" shows and the moving-picture shows to know the interest that is aroused by views projected upon the screen. Things appear to stand out in three-dimensional space and the perfect illusions might almost cause one to mistake the representations for the realities. No one ever obtained much of an idea of a glacier from an ordinary picture and verbal description. But I have seen stereopticon views that almost made one hear the detonation as immense blocks of ice fell into the sea. What promises to be of vastly greater value still is the kinematograph which will produce the moving picture. What complex scenes are we not able to portray vividly to the eye. One only lacks real auditory impressions, and they will be awakened through imaginative representations. Every school-room should at least be supplied with a good lantern and it should be a part of every teacher's equipment to know how to operate it. The moving-picture machine is now so perfect that it is to be hoped the day is not distant when every school shall possess one.

These perceptual notions should more and more be enriched through the images reproduced from former perceptions. The words of the teacher and descriptive books should also bring often into requisition as large a stock of images as possible. Finally, when a vast array of fundamental notions has been derived through the medium of sense-experience the representations may be stimulated entirely through verbal description.

[1] *School Review*, 8 : 573.

Thus by the time a pupil is able to read standard literature it ought to be no longer necessary to resort to objective or pictorial illustration to convey the pictures delineated by the writer. They ought to be called into being by their verbal symbols. But until the word has received a content based upon experience the word can call up no image. In this higher stage, which is of equal importance with the lower, new pictures are created through combination of the pictures suggested by the words.

If geography is taught according to the method suggested it may become one of the richest subjects in the whole curriculum. It need no longer remain "the poor man's study," but one which is rich in basal concepts for almost every other subject. It furnishes most of the fundamental apperceptive content for the material sciences, and dealing as it does with life in all its relations, it furnishes the indispensable preliminary to the understanding of literature, history, commerce, economics, politics, and even education and religion.

Imagination in Scientific Study.—"Physical investigation, more than anything else besides, helps to teach us the actual value and right use of the Imagination," said Sir Benjamin Brodie in an address to the Royal Society.[1] It is not only important as a means of training but the sciences themselves could never be profitably pursued without a judicious use of the imagination. The same noted authority says that this power when "properly controlled by experience and reflection, becomes the noblest attribute of man; the source of poetic genius, the instrument of discovery in science, without the aid of which Newton would never have invented fluxions, nor Davy have decomposed the earths and alkalies, nor would Columbus have found another continent."

It needs to be clearly understood that the repicturing of things exactly as they are is the essence of imagination. To look upon a plant and then when it is no longer present to recall its details of root, stem, branches, leaves, color, or shape, is to imagine. To observe a hydrostatic press and later recall the relations of

[1] Quoted by Tyndall, *Fragments of Science*, p. 417.

the lever, piston, valves, bolts, and standards, is to exercise imagination. The student who looks through the microscope and sees unicellular beings, then turns away and draws them exactly is exercising imagination of the most accurate kind. To view the proper geometric figure in connection with the Pythagorean theorem and then without having the book or paper present to see the figure and all its relations with the mind's eye, is to exercise imaginative processes no less than to write a book of fiction. In fact the former is the more fundamental and the latter is apt to be incoherent, hazy, and inexact unless a foundation has been laid through imagination of the former, exact, reproductive type. Imagination is employed in acquiring and recalling the concrete details of science no less than in building up notions of relations and theories which have not been tested by observation of material things. Reproductive imagination is employed in the former case, productive or constructive in the latter. The former is prerequisite to the latter, a fact which is so often overlooked. If this exact reproduction of definite notions of material things, gained through the senses of sight, sound, touch, taste, smell, and weight is insisted upon the combinative imagination will almost take care of itself. At any rate, there is no place for the latter without definite images to combine. Thus the scientist with his exact consideration of material things has as much—I am inclined to think much more—to do with the development of powerful creative imaginations as the poet, the painter, or the sculptor.

President Eliot said:[1] "The imagination is the greatest of human powers, no matter in what field it works—in art or literature, in mechanical invention, in science, government, commerce or religion; and the training of the imagination is, therefore, far the most important part of education. . . . Constructive imagination is the great power of the poet, as well as of the artist, and the nineteenth century has convinced us that it is also the great power of the man of science, the investigator, and the natural philosopher. . . . The educated world needs to recog-

[1] *Proceedings of the National Education Association*, 1903, p. 51.

nize the new varieties of constructive imagination. . . . Zola, in *La Bête humaine*, contrives that ten persons, all connected with the railroad from Paris to Havre, shall be either murderers or murdered, or both, within eighteen months; and he adds two railroad slaughters criminally procured. The conditions of time and place are ingeniously imagined, and no detail is omitted which can heighten the effect of this homicidal fiction. Contrast this kind of constructive imagination with the kind which conceived the great wells sunk in the solid rock below Niagara that contain the turbines, that drive the dynamos, that generate the electric force that turns thousands of wheels and lights thousands of lamps over hundreds of square miles of adjoining territory; or with the kind which conceives the sending of human thoughts across three thousand miles of stormy sea instantaneously on nothing more substantial than ethereal waves. . . . There is going to be room in the hearts of twentieth-century men for a high admiration of these kinds of imagination, as well as for that of the poet, artist or dramatist. . . . It is one lesson of the nineteenth century, then, that in every field of human knowledge the constructive imagination finds play—in literature, in history, in theology, in anthropology, and in the whole field of physical and biological research. That great century has taught us that, on the whole, the scientific imagination is quite as productive for human service as the literary or poetic imagination. The imagination of Darwin or Pasteur, for example, is as high and productive a form of imagination as that of Dante, or Goethe, or even Shakespeare, if we regard the human uses which result from the exercise of imaginative powers, and mean by human uses not merely meat and drink, clothes and shelter, but also the satisfaction of mental and spiritual needs."

We have already indicated that nature study furnishes valuable training in exact imagination. It is also a special theatre for the development of the constructive imagination. Child-life loves nature. Most children are happiest when in direct contact with nature. Not alone because the conventionalities of civilized life are cast aside, but also because it offers attractions of

its own. That is, it is attractive if studied as a unity. In early child-life it should not be minutely analyzed and studied apart from its natural setting. It should not be dissected and sliced and teased apart until nothing related remains. One of the great lessons that should be felt at least is that of the unity of all nature. The child naturally seems to feel this unity, and unless the feeling is carelessly destroyed it may promote the highest of all interests—religious interest. All forms of nature are eloquent teachers. They appeal to the child's imagination in a way that no human being could. Contact with nature is a most genuine, eloquent exhortation to a contemplation of the Divine. Consider the feelings awakened and the imaginative scenes produced by viewing the mighty ocean, the virgin forest, the beautiful fields, the tiny babbling streamlet, the lurid lightning flash and the thunder peal of a storm! All the poets have sung of the emotions awakened through the contemplation of nature, and an appeal to individual experience can but confirm the reasons therefor. An investigation carried out by the writer a few years ago in which the experiences of many children were collated, gave striking evidence of this universal reverence for nature. When alone with the forests, the rocks, or the sea, for companions, one's thoughts turn instinctively toward the contemplation of the universal, which cannot but lead to a search for the primal cause, for the constant, the all-powerful—for God. To the thoughtful child it is inevitable that he should picture the world beyond, from that the cause of the world, the cause of that cause, and so on *ad infinitum.* The earliest conclusions are that there is a suprasensuous being that acts upon the sensible world. Here we have the root idea of all religions. It is concrete, every force and every being is imaged. Now all of this play of the imagination is perfectly normal and healthy. In fact it is necessary to advancement. A similar play of the imagination in building new theories and constantly wondering is at the basis of all true learning.

For one with some genius in painting no better foundation for science could be had than an exact and exacting course in de-

scriptive geometry as given in an engineering school. Doubtless all our great painters and sculptors owe much of their success in producing ideal creations to their exact knowledge of anatomy and architecture. These subjects are always prescribed in schools of art. A great architect must see every minutest detail even in his most unique creations. It is said that Michelangelo before beginning to decorate a room in fresco spent days and days studying intently the bare walls and picturing exactly what was to appear. Some one remonstrated with him for such a waste of time, but he said: "I have to see my picture before I can paint it." "With accurate experiment and observation to work upon, imagination becomes the architect of physical theory. Newton's passage from a falling apple to a falling moon was an act of the prepared imagination, without which the 'laws of Kepler' could never have been traced to their foundations. Out of the facts of chemistry the constructive imagination of Dalton formed the atomic theory." [1] In the study of sound the imagination must be called upon to transcend actual experience. "The bodily eye, for example, cannot see the condensations and rarefactions of the waves of sound. We construct them in thought, and we believe as firmly in their existence as in that of the air itself." [2] Then carry it over into the realm of light. In microscopic work only flat surfaces are seen—the imagination must build up the third dimension and the relations between the parts.

Just because natural science deals with objects perceived by the senses it affords unsurpassed opportunities for imagination. As indicated it need not be confined to exact copies of things perceived. It may be used to recombine in the most unheard-of ways. It may picture the most fantastic combinations and conceive of these elements as working according to laws before undreamed of. In fact this is the course of science. It is not unscientific to do this provided we further do what the true

[1] Tyndall, *Fragments of Science*, p. 419.
[2] Tyndall, *op. cit.*, p. 421.

scientist does, viz., test the conclusions. Barring the small part played by accident in discovery this has been the course followed in the development of science. "First comes the conjecture pictured by the imagination, then logic and reasoning, then the test by observation and experiment. This is the necessary order of discovery, and it is the best order for the student who will follow in the footsteps of the discoverer. It is, and must be, the path of the discoverer. His mind must work pictorially." [1]

Imagination and Invention.—In every invention a result to be attained has to be pictured and then known appliances tested to see how far they will meet the requirements. If they fall short they must be varied and combined and recombined in such a way as to reach a result. The man who invented copper toes for shoes asked himself: "What will make that part of the shoe wear as long as the rest?" He set about imagining various things that would produce the result. Copper caps were finally hit upon and the inventor was made rich. The invention of the steam engine was a similar process. What new motive power can be used in exerting great force? was the question set. Steam had lifted the lid of the tea-kettle and the imagination confined great amounts of steam in a cylinder, and then conceived a piston to compress the air and the problem was solved. The imagination has discovered atoms and worlds; it has penetrated the interstices of all matter; it has encompassed in its glance the limits of the universe; it has espied the invisible force which unites all things terrestrial and celestial; it has stolen the secret laws of all the varying changes in the universe; it has enslaved these laws and forces; it has joined them in infinitesimal permutations; it has harnessed the cosmic forces singly and tandem in n-fold forms and caused them to do service from the most menial to the most exalted; it has ploughed our fields and garnered the bounteous harvests; it has lighted our homes; it has clad us warmly and fed us bountifully; it has provided us æsthetic enjoyment as in music, art, and poetry; it has girt the globe with means of transit; by its achievements knowledge of the thoughts

[1] Tyler, *School Review*, 6 : 721–2.

and actions of all mankind is borne on lightning pulsations to every corner of the globe.

Imagination in the Study of Literature.—In training the imagination in literary study first see that the literature studied is imaginative; and then let it appeal to all the senses so that literature may quicken the boy to say like Christopher Sly:

> "I see, I hear, I speak;
> I smell sweet savors, and I feel soft things."

Further, the laws of apperception must be heeded. It is absurd to expect the child to imagine when no elements are already in his possession. Parts of *Childe Harold*, though beautiful verse, would awaken no representations in the mind of a reader unacquainted with Italian skies. Similarly *The Lady of the Lake* would call up very little visual imagery to a child not made acquainted, through personal observation or pictorial representation, with the Scottish mountains, lakes, and Highland costumes. What vague, distorted pictures must be evolved by children, life-long residents in the slum districts of a metropolitan city like London or New York, and who have never made an excursion beyond their own ward, when they read the opening stanza of Gray's *Elegy*:

> "The curfew tolls the knell of parting day,
> The lowing herd winds slowly o'er the lea,
> The ploughman homeward plods his weary way,
> And leaves the world to darkness and to me."

They have never beheld a herd, perhaps not even a cow; their only estimate is one gained from pictures, and undoubtedly many a boy has thus gained the idea that a cow and a mouse are of the same size. They have never seen a lea; perhaps have never set foot on earth—only on pavements. The picture of a fading, glimmering landscape is undreamed. Most of the imagery suggested in the first seven stanzas would be impossible to such children until they were provided with the necessary background of sensory experience. This leads us to the very practical question as to how the sense-perceptions may be supplied? It

must be granted that it is not so easy to secure as to prescribe, but that in no wise vitiates the theory nor does it lessen the desirability nor the imperativeness of providing in every manner possible for a rich perceptual life. And whenever we cannot resort to nature we must resort to art to assist us. In many cases where words are entirely inadequate, and objective illustration impossible, pictures, diagrams, and charts can come to the rescue. Pictorial illustration as an aid in teaching was initiated by that noble and prophetic old Moravian, John Amos Comenius, nearly three hundred years ago, but the manifold use of visual representation is only yet in its infancy. The stereopticon can be used as well in literature as in geography and physics. A good stereopticon ought to be a part of the equipment of every school-room, not one for every building, but one for every room, for every grade, and every teacher ought to be instructed in the technique of its manipulation. Take, for example, Irving's *Westminster Abbey* and combine the effect of lantern views with the verbal description given by Irving and how much greater would be the effect than by the verbal description alone. In my own case the careful study of the verbal description failed to give me a picture at all corresponding to reality. Upon visiting the abbey I was not a little surprised to find how erroneous my notions were concerning it. A few lantern slides would have changed my ideas entirely. It has been well said that the foreign traveller gets only as much history or geography through his travels as he takes with him.

Gordy wrote aptly:[1] "You would not hire a man to build a house without furnishing the necessary materials. Be equally reasonable with your pupils, and do not expect them to build images out of nothing." Many teachers of reading do, however, make this very mistake. They expect literature to furnish the basal imagery, when it should only be employed to suggest, recall, and recombine images elsewhere gained. Instead of beginning with literature in training the imagination it should be the last stage.

[1] *New Psychology*, p. 270.

The German poet voiced the idea in saying:

> "Wer den Dichter will verstehen
> Muss in Dichters Lande gehen."

German teachers make much more use of objective or "Anschauung" material than American teachers usually do. In teaching the classics and the modern foreign languages the attempt is made to place the pupil in the midst of the people and places which he is studying. When studying Rome, he is to see the Romans as they were. Roman soldiers and citizens had distinctive appearances in dress. The pupil must not think of them in German soldiers' and citizens' dress. For example, life-size pictures of a Roman soldier, with helmet, shield, javelin, and short sword, or of citizens with the toga, form a part of the objective material for the lesson on one day. On another day the Roman Forum or the Athenian Parthenon is shown in drawings on a large scale. When possible, many of the implements of war or those used in the industries are brought in from the museums for inspection. Frequent trips are made to the museums which are found in every town of any size. In America we still have to learn the educational value of museums. In Germany, "Greek and Roman statuary are on every hand, not usually in the school-room, indeed, but accessible, and ancient forms of architecture may be pointed out by the teacher during any lesson. In this way the subject becomes full of interest and reality. It assumes an ineffaceable meaning not to be lightly esteemed. I have often observed the correlation of art with mathematics, as well as with history—for example, in connection with the Pythagorean theorem, the Conchoid of Nicomedes, or the octagonal form of the Roman Forum." [1]

In attempting to train the imagination through literature we may learn a valuable lesson from a psychological analysis of some of the best imaginative literature. We need to bear in mind that those images which are clearest and most vivid are the ones that are most easily described. Hence we know that

[1] See the author's *Secondary School System of Germany*, pp. 191, 209.

those descriptions which are most accurate and convey the clearest pictures to the reader are descriptions of things which have come within the writer's actual experience. Scott, bred elsewhere, could never have delineated such masterpieces as *The Lady of the Lake*, *Ivanhoe*, and *Marmion*. Byron without actual knowledge of Lake Geneva, Swiss mountains and castles, and the political vicissitudes of that country could never have penned the *Prisoner of Chillon*. No other environment could have furnished the same images and stimulated him to describe them with the same realistic touches. *The Cotter's Saturday Night* could not have been written by one unpossessed of a life-long familiarity with Scottish life. Irving, living in the Carolinas or California, could never have depicted the ideal Dutch life in old New York nor the *Legend of Sleepy Hollow*. Though ideal and fictitious, they are true representations of what has been lived. No one but a Yankee bred could have written "When the frost is on the punkin," and only a child-lover and observer could have produced those sweet, inimitable poems given to us by Eugene Field. Halleck has studied the greatest bard of all the ages, Shakespeare, to determine the secret of his great imaginative resources. He has shown that Shakespeare's works are replete with allusions to nature. The images described are not confined to sight alone, but all the senses are appealed to—sight, hearing, touch, taste, and smell. Those scenes Shakespeare would never have been able to represent without first-hand knowledge of all the things he has depicted. The poet's early life was spent out of doors, in contact with the fields, the woods, the birds, and the animals. Though his parents could probably neither read nor write, the young Shakespeare received a splendid education; that is, through sensory training he obtained a vast store of images which were later woven into such marvellous combinations.

A few examples will illustrate the use he has made of these images in penning beautiful similes and metaphors. He, to be sure, is not to be classed among the nature poets, who aim to describe nature in song. His chief theme is human nature, but

since all things abstract are best described through the concrete, let us note how he uses sense-perceptions to build up ideas of the most abstract relations, and the deepest human sentiments.

To give an idea of *time* he uses many figures, comparing it to material things:

> ". . . and thus the
> whirligig of time brings in his revenges."
> —*Twelfth Night*, V : 1, 453.[1]

> "Time is a very bankrupt and owes
> more than he's worth to season.
> Nay, he's a thief too: have you not heard men say,
> That Time comes stealing on by night and day?"
> —*The Comedy of Errors*, IV : 2, 172.

Age is portrayed in a realistic way in the following:

> "These eyes, like lamps whose wasting oil is spent,
> Wax dim, as drawing to their exigent;
> Weak shoulders, overborne with burthening grief,
> And pithless arms, like to a wither'd vine
> That droops his sapless branches to the ground:
> Yet are these feet, whose strengthless stay is numb,
> Unable to support this lump of clay,
> Swift-winged with desire to get a grave,
> As witting I no other comfort have."
> —*King Henry the Sixth*, 1st Part, II : 5, 66.

He portrays *ambition* in manifold ways, among them the following:

> "This is the state of man: to-day he puts forth
> The tender leaves of hopes; to-morrow blossoms,
> And bears his blushing honours thick upon him;
> The third day comes a frost, a killing frost,
> And, when he thinks, good easy man, full surely
> His greatness is a-ripening, nips his root,
> And then he falls, as I do. . . ."
> —*King Henry the Eighth*, III : 2, 240.

[1] The text here followed is that of the "Eversley Edition," edited by C. H. Herford, and published by Macmillan & Co.

Note how he represents *adversity:*

> "O, how full of briers is this working-day world!"
> —*As You Like It,* I : 3, 488.

> "Sweet are the uses of adversity,
> Which, like the toad, ugly and venomous,
> Wears yet a precious jewel in his head;
> And this our life exempt from public haunt
> Finds tongues in trees, books in the running brooks,
> Sermons in stones and good in every thing."
> —*As You Like It,* II : 1, 493.

Imagination and Dramatization.—The dramatic instinct should be utilized in securing clearness of perception and vividness of imagination. In childhood the motor activities are most pronounced and the impulse to action is very great. Acting the parts represented in a reading lesson is a valuable stimulus to thought and an efficient means of impressing the scenes upon the memory. Many pupils never gain the slightest suspicion that much ordinary literature should suggest to their minds pictures like those seen on the stage. They have never thought that many or most dramatic stage scenes have been portrayed in ordinary prose or poetic form with exactly the same plots and dramatic situations depicted, and that the particular form as a play is assumed for the purpose of securing the dialogue form. Encourage the pupils to act out some selections, *e. g.*, *Miles Standish, The Sleeping Princess* by Tennyson, Jean Ingelow's *Songs of Seven,* none of which were written for the stage. Have them arrange the stage scenes that might be arranged if the selections were played. Work out costumes and scenery and help them to impersonate the characters portrayed. In this way there will dawn upon them a realization that such literature is an artistic representation of imaginative creations. What has been dull, uninteresting, and inanimate now becomes fraught with life. That the writer has depicted human experiences in scenes which they are to build up in imagination will be for them a new conception. A few weeks spent with a class in the inter-

pretation and representation of a single selection will give pupils more insight into the rich possibilities to be gained from reading than years of the ordinary saying of words. Every school building containing several rooms should be provided with an auditorium and a stage where pupils can practise dialogue reading and impersonation. This stage should not be used chiefly for theatricals, but as an accessory in the interpretation of literature.

Imagination in Composition-writing.—The so-called "language lesson" may be very helpful in training pupils' imagination. In turn, the judicious use of the imagination will be found one of the best aids toward better language work. Language should always be used for the purpose of expressing ideas, clearly, accurately, forcibly, and æsthetically. The imaging power is one of the first requisites in securing clear and accurate ideas; and when these are secured the proper expression follows naturally to a considerable extent. Force and beauty of expression are not necessary accompaniments of clear imagery. The judicious selection of imagery which is to be included in the constructive product must be taught. The first way of cultivating this power is to have pupils follow imaginary literature. Second, they should be led to reproduce the imaginary stories. Third, they should be led to construct imagery for themselves. To accomplish this last step the teacher will need to try various devices. There will be little trouble in securing the delineation of something imaginary. But in order to secure the description of imaginary things true to life, consistent and logical, much training will be necessary. One way, which the writer has seen tried very effectively, consists in having children write imaginary autobiographies of various articles. Take for example, a pin, a shoe, a hat, a tin can, a sled, or a watch. This will furnish great scope to the play of the imagination. All sorts of episodes may be contrived and yet the narration must be consistent with fact. A battered old hat or a silk "tile" may form the central theme, but it would not do to have the battered old hat and a fashionable young "swell" coupled together, nor a poor boy

begging for bread buying a silk "tile." If children once hear a story of this kind it is surprising what faithful pictures involving flights of fancy they can depict. They do it with great zest, too. Another device is to read a story until a very interesting part is reached, then stop and ask the class to finish it.

In imaginative literature great skill is demanded in artful simile and metaphor making. The description of one unknown thing in terms of something familiar and perfectly concrete is a part of the work that taxes a writer most severely. These comparisons are necessary, not alone for the artistic touch, but for strength and clearness. Any one could say: "The glacier moved very slowly, at the rate of a mile an hour, and it did not move in a straight line, and occasionally tumbled over," but see how much is added to the mere understanding, to say nothing of the beauty, when Shelley writes:

> "The glaciers creep,
> Like snakes that watch their prey from their far fountains,
> Slowly rolling on."

The imagery was greatly enhanced. Had we even used the word tortuous, the picture would have been much richer than with no suggested imagery.

Read to the children the first part of some simile and ask them to complete it. They will soon catch the spirit and will surprise you by the apt comparisons they make. Some unlettered country people who have been good observers often make most striking comparisons. On the other hand when we begin to consider the number of original similes that the average educated person makes we are surprised at the paucity of original comparisons. If many comparisons are indulged in they consist usually of stock illustrations preserved by a faithful verbal memory. They are used on all occasions and often with little appropriateness. Witness the various uses of the words "nice," "lovely," "great," "right," "proper," etc. To be sure the most fitting time to make fine phrases is when under the inspiration of an emotion that sways the whole being. But the

class-room is a good place in which to show what may be done and to initiate the habit of using expressive language, so that when the wave of emotion does overwhelm one it may be expressed in the best way possible. To show that children naturally learn to express themselves in metaphorical terms, let us quote a simile expressed by a four-year-old child. She had been watching the shooting of fire-crackers and had observed those sputtering ones that we boys called "scizzers." She wanted to tell about that species of cracker, and said: "They sound just like a dog when it snuffles." Who can suggest better images to use in the description? Better language might be chosen, but the ideas could not be selected better. Think of one of the objects and you can *hear* the other. The production of an appropriate sound image was desired. The image of the "snuffling dog" was sufficient to arouse it.

The value of *improvising* must not be overlooked. All the materials for any picture of imagination have been gained through sense-perception, and they have been conserved by the memory. One of the characteristics of a good imagination is a readiness in reproduction of the memory images and a quickness in combining these into new wholes. The most ordinary and prosaic minds can usually recognize the fitness of the combination, when once produced, but their slow minds cannot call up previously recorded images fast enough nor can the result of combinations be taken in swiftly enough. The poet, the wit, and the successful extemporaneous speaker are all persons who have ready memories and who make lightning associations. They sometimes jump at conclusions, but they cannot be charged with wearisome reflectiveness. Ofttimes one who is not an off-hand speaker may still produce fine word descriptions in writing. He lacks only the readiness necessary for extempore speaking. The power of marshalling quickly all one's ideas on a given subject and launching out toward new conclusions is very valuable, and practice in so doing will increase one's facility very much. Exercises in improvisation are very helpful especially to those naturally slow.

In teaching students to write the same mistakes are frequently made as in interpreting literature. They are asked to write imaginative stories when they have no foundation in experience. Instead of writing trash with no significance they should go out into the world to gain first-hand personal experiences. Pupils write perfunctorily because they *must say something* rather than because they *have something to say.* "Out of the fulness of the heart the mouth speaketh." No writer of descriptive or imaginative composition has ever depicted anything that could live unless he gave it out of the fulness of experience. The college student should never be deluded into thinking that he can become a great writer by merely studying rhetoric. The fundamental prerequisite of all worthy composition is a rich fund of personal experiences. Travel, observation, study of objects and problems in the concrete are the only efficient basis for authorship. Mark Twain's most famous production could never have been sketched by one who had not spent his days and nights as a Mississippi River pilot. Charles Reade's *Cloister and the Hearth* or Hugo's *Les Miserables* were only possible to men who had studied every inch of territory and mastered the entire life and spirit of the times and places portrayed. If some of our fledgling writers of fiction dealing with social problems would go into the slums, mix with the working man and the capitalist, become citizens and meet the politicians, become tramps, wage-earners, or something to gain real experiences of which they want to write they would produce much less bizarre and visionary conclusions. If some of the callow youths who are producing the deluge of "short stories" dealing with love would only wait until they had had an opportunity to speak from personal experience, we should be spared the plague of frothy, drivelling sentimentalism, which cannot fail to instil the most perverted notions regarding life's most sacred drama and the establishment of the fundamental unit of society—the home.

Imagination in History.—Tolstoi claims that children are interested in history, not because of the facts, but because of the artistic dramatic relations calling the imagination into play. I

shall allow the distinguished Russian to speak for himself: "I am convinced that all the characters, all the events of history, interest the pupil, not by means of their historical significance, but on account of their dramatic attraction, by reason of the art displayed by the historian or more often by popular tradition. The history of Romulus and Remus is interesting, not because these two brothers founded the most powerful city in the world, but because it is attractive, pleasing, wonderful. In a word, the child does not have a taste for the history itself, but for the art." [1]

History affords a golden opportunity for the use of the imagination, both reproductive and constructive. To study history aright we must not only understand the chronicles, but we must see, hear, and follow the historic personages. Listen to Burke's speeches! See Webster's full rounded visage with eagle eyes as he pleads the cause of liberty and union! Not only see and hear, but feel all the stirring emotions that welled up in his own heart and in the breathless audiences that actually listened. Read the speeches aloud, not silently—have the pupils practise a term if need be to render the selection in a manner that will make you feel the change of blood-flow and the heightened emotions. Oratory appeals to the ear and not to the eye. Hence, how can pupils imagine oratory unless it is in terms of hearing? Listening to impassioned speeches will tend to make all speeches ring through their ears and thrill every fibre.

Training Through the Fine Arts.—Undoubtedly much more of an attempt should be made to develop the imagination by means of the fine arts. More people than we assume are lifted to ideal planes by means of painting and sculpture. Pictures are too costly for large individual collections and only the cheapest copies can be obtained by the poor. But in our large cities public art galleries ought to be numerous. Professor George Harris believes that "the love of pictures is almost universal." In support of this belief he says: "When a loan exhibition of paintings is opened at the South End in Boston, throngs of

[1] Quoted by Compayré, *Psychology Applied to Education*, p. 74.

manual laborers take the trouble to procure tickets, and comply with the request to indicate preferences, the best pictures always having a majority of votes. Wealthy men that collect fine paintings become more interested in pictures than in business. In fact, almost any avocation which is intellectual, artistic, scientific, or literary elevates and idealizes."[1] The German people are more idealistic and are they not raised more above the sordid, utilitarian life than we? Is it not discernible in the university life, in the happy burgher who sings the national songs while at his round of daily toil, and in the company of soldiers who go marching to the drill ground at daylight listening as they march to the inspiring national airs? Their songs all idealize the *Vaterland.*

Necessity of Cultivation.—Lastly, to train the imagination the child must imagine. That is, he must represent, must image the things perceived or verbally portrayed and should also recall them frequently. A good means of clarifying imagery and making it definite is to require graphic or scenic representation of things delineated. Good Herbartians all require children to construct Robinson Crusoe's tools, weapons, huts, etc., and the "culture epochs" devotees all have made sufficient supplies of Hiawatha's wigwams, birch-bark canoes, and moccasins to stock many museums. Their procedure exemplifies good pedagogy of the imagination. *Snow Bound*, *Miles Standish*, *Rip Van Winkle*, every lesson in history, geography, and science offer abundant opportunity for recall through imagery of the ideas gained. I have emphasized strongly the necessity of sensory experience as basal to all imagination. But that is only the first step, and we must not overlook the importance of adequate exercise in repicturing what has been perceived. It is easily possible to allow the child to live too much in the realm of sense-perception. Hinsdale says we keep the child too long "thinging it" and Schaeffer says the child deals with blocks so long that he becomes a blockhead. Representation is a higher process than presentation and progress means that the child must advance to

[1] *School Review*, 6 : 700.

the highest possible stage. Important as laboratory work is, it may degenerate into the most paralyzing sort of instruction if there is no opportunity for recall and reflection stimulated by the recitation and generous questioning. I have known even college students to rush through a year of physics or chemistry with no other aim than to finish the prescribed number of experiments. Mere text-book work with a Socratic teacher would be as valuable, for it would at least stimulate reflection and necessitate imagery of the chance personal experiences. One of the main purposes of the recitation is to give this very opportunity for revival of images. It is also a means of suggesting new combinations and relations and producing new imagery.

Imagination in Every-day Life.—While stress has been laid on the education of the imagination in connection with school subjects, it must not be inferred that imagination is of value in scholastic life only. No power of the mind should be more active in performing the duties outside of school, and the purpose of the school training is in part to make the individual more efficient and happier in the extra-school occupations throughout the rest of his life. The imagination is needed in every art, trade, craft, or occupation. For example, the efficient blacksmith must see exactly, in imagination, the horse's hoof to be shod, the wagon tire to be fitted, the function of the bolt or brace; and then he must hammer the iron and steel to fit the particular case. The painter, the carpenter, the architect, the watchmaker, the machinist, the inventor, the type-writer, the printer, the landscape gardener, the tailor, the dressmaker, the milliner, the musician, the farmer—all need well-trained powers of imagination if they are to succeed in life.

Wonders of the Imagination.—In closing, we may echo the statement of Robert Witt that "the possession of a vivid imagination, of the imaginative faculty in all its variety and many-sidedness, is a gift of the gods themselves, and, as it were, priceless. Imagination has the power to alter the face of the world, to bridge distance, to annihilate time; like an alchemist it can

transmute, refine, transform; like the artist it is skilful to glorify and to enrich. On the moral side of life it knows how to comfort and encourage, to inspire and control, to animate and to rejoice." [1]

[1] Robert C. Witt, *Westminster Review*, August, 1900.

CHAPTER XX

APPERCEPTION IN RELATION TO EDUCATION

General Illustrations of Apperception.—Lloyd Morgan says[1] that "As my friend and I are walking along the road, during a pause in our conversation we pass a gate at which some cattle are standing. We both begin to speak at once, and, after mutual apologies and the usual courtesies, he takes the precedence, and tells me of the Red Devons with which he has stocked a farm which he has lately purchased. When he has spoken, he asks me what I was about to say; and I laughingly reply that I was merely going to ask whether he thought certain recent promises to electors (1892) were much more likely to be fulfilled than certain other promises in 1885 concerning three acres and a cow. Now here a similar impression, the result of primary suggestion, gives rise in two different minds to two different trains of ideas. . . . There is not much difficulty in assigning, in general terms, reasons for the different results in his mind and in mine. His farm in Devonshire had been for some time a topic of thought and discussion, his mind had a constant tendency to revert to this subject. . . . Probably the farm was lurking in the background of his consciousness as he walked silently by my side. On the other hand, my own mind was, as we say, full of the elections, and of certain statements reported to have been made in Wiltshire to catch the agricultural vote. The cow appeared to me therefore in an electioneering connection. Had a butcher been with us, the cattle might well have suggested the peculiar excellence of last year's Christmas beef. Or if a student of prehistoric archæology had been there, his

[1] *Introduction to Comparative Psychology*, p. 63.

mind, through the intervention of *Bos primigenius*, might have wandered to the Europe of primitive times."

Steinthal tells a story to illustrate how each person's apperceptive masses color all his mental processes. Six persons, strangers to each other, were riding together one day in a compartment railway carriage and one of them proposed to tell the vocation of all the rest if they would each write without hesitation the answer to a question which he would give them. The question was: "What destroys its own offspring?" One wrote, "Vital force," and was promptly told that he was a biologist. The second wrote "War," and was picked out as a soldier. The next was called a philologist because his answer was "Kronos." The journalist of the party had disclosed his identity by writing the word "Revolutionist," and the farmer by writing "Boar." "Each one," says Steinthal, "answers the first thing that occurs to him, and that is whatever is most nearly related to his pursuit in life. Every question is a hole-drilling experiment, and the answer is an opening through which one sees into our interiors. . . . We are able to recognize the clergyman, the soldier, the scholar, the business man, not only by the cut of their garments and the attitude of their bodies, but by what they say and how they express it, . . . by the point of view from which they regard things, judge them, conceive them, in short by their mode of apperceiving."

Emerson wrote: "What can we see or acquire, but what we are? You have seen a skilful man reading Vergil. Well, that author is a thousand books to a thousand persons. Take the book into your hands, and read your eyes out; you will never find what I find. If any ingenious reader would have a monopoly of the wisdom or delight he gets, he is as secure now the book is Englished, as if it were imprisoned in the Pelews tongue." According to our training, unfortunately we are apt to look upon one of the political parties as being absolutely right and the others as wholly deluded. Similarly our views of religious denominations and even moral questions are sometimes terribly warped by the example and teachings we have received. The

Hindu woman casts her babe into the Ganges to be devoured by alligators because she believes such action to be right. Her religion teaches her to do it, and frequent examples seem to justify the conclusion. The savage believes it to be right to rob or slay his enemy, while civilized nations declare against such practices.

In order to understand much of ordinary conversation it is necessary to have a large fund of information to form a background for its interpretation. The child's readers doubtless always contain innumerable common words, of which the child has no knowledge beyond their sound. Any teacher who will take the trouble to investigate may be astonished to discover that some of the most ordinary terms are practically meaningless to the children. President G. Stanley Hall in his classical study, "The Contents of Children's Minds on Entering School" (later discussed), astounded many by his revelations of the ignorance of children concerning supposedly familiar words and objects.

It is not difficult to recall illustrations showing how variously different persons look upon the same event. The artist viewing Niagara Falls goes into ecstasy over the magnificent scenery; the engineer says: "What tremendous water-power"; the geologist studies the rock strata, the force of the current, and computes the age of the earth; the farmer says: "What a waste of farming land." We are told that one lady who visited there after dilating upon the wondrous scenery turned to her boy, who she thought must be awe-struck by the grandeur, and inquired what he thought of it. Imagine her amazement when he calmly inquired: "Is that the kind of spray you spray my nose with?" In childhood one is accustomed to think that the hills he knows are so high, the valleys so deep, the rivers so broad, the buildings so large, and the people so great. He goes away for a few years, returning a grown-up, and anticipates with eagerness the re-experience of the same childhood's sensations. Alas, the disillusionment! The hills have dwindled, the valleys have been filled, the buildings have become shrunken, and the people are

so ordinary. "How changed is all!" he exclaims. "It was not thus when I was a child." But he should know that it is he who is changed. The "eternal hills" have remained practically as they were. But the new scenes and the new life which he has experienced have given him glasses colored with interpretations which he can never lay aside. Not only have the new ideas been interpreted through old ideas, but the old possessions have been modified by the new.

Children's Understanding of Words.—The incorrect use of words by children may be frequently traced to entirely erroneous ideas back of them. The wrong words substituted reveal the incorrectness or the narrowness of their apperceptive masses. The right words are not employed solely because there is no conception in the mind corresponding to them. The conceptions that are a part of the mental possession force themselves to the foreground and the words representing them are their natural expression. A child said: "Blessed are the shoe-makers," etc. When he had heard the word "peace-makers," no correct idea had been gained through the word and the expression linked itself with the nearest known idea. The following mistakes illustrate the same point. A child heard the verse: "A double-minded man is unstable in all his ways." He rendered it thus: "A double-minded man is in the stable all the time." A child said: "An average is what a hen lays on." He had heard some one say that "a hen lays on an average one hundred eggs in a season." I said to my boy of three: "That is a freight train." "Why is it afraid?" said he. Children on first seeing snow on the ground frequently call it sugar or salt. As it floats down they hail it as feathers or as butterflies. A child on seeing a pot of ferns called it a pot of green feathers. James says the sail of a boat is called a curtain by the child. His "child of two played for a week with the first orange that was given him, calling it a 'ball.' He called the first whole eggs he saw 'potatoes,' having been accustomed to see his 'eggs' broken, into a glass, and his potatoes without the skin. A folding pocket-corkscrew he unhesitatingly called 'bad-scissors.'"

Children unreflectingly often mistake new words for those that are similar. A "guardian" is thought to be a "gardener," a "salon" a "liquor-shop." They make many curious errors in interpreting words having a variety of meanings. They think "dressed beef" has on some sort of clothing. A class of mine were told one day that we send ministers to England and other foreign lands. One child reported the next day that we send preachers to England. The children in an upper grammar school of Berlin were asked what mountain (*Berg*) they had seen and all answered *Pfeffenberg*, the name of a beer-house near by. For all of them *Berg* meant a place of amusement. This, as Dr. Hall says, would cause an entire group of geographical ideas to miscarry. My children had heard us talk about picking out (selecting) goods from a catalogue. One boy of two years brought me the catalogue opened to a picture of a horse and asked me to "pick it out," expecting a real live horse to be taken out. A boy of two said: "I saw the trains unhitch." Another child asked a deaf person: "Are you blind in your ear?" A farmer's boy of ten inquired: "Will bees sting when they are not sitting?" (His experience with cross sitting hens had made him suspicious.) Other examples illustrating essentially the same mental reaction are given in the chapters on imagination and thinking.[1]

Perception and Apperception.—From the foregoing illustrations we clearly see that it is not alone what we gain through sensory data that determines what we shall perceive or think. The mind itself contributes the essential factors which give our perceptions significance. Though the same outward stimuli may be presented to the dog and the doctor, what each really perceives are separated by impassable chasms. The ideas which each one secures through the impressions are determined not so much by sensory data as by previous experiences—per-

[1] Consult, also, Caroline Le Row's *English As She Is Taught*, Century Co. It is made up of actual answers written by pupils in examinations. The introduction by Mark Twain does not seem at all funny when compared with the pupils' answers.

sonal or ancestral. That is, what is perceived is also *apperceived.* By using this term it is not intended to show that there is a special process which we may call apperception. It simply shows the resultant of all the associative forces that are continually operative in determining our currents of thought. The study of association has shown that the character of previous experiences, their recency, habits of thought, memory, education, health, emotional tone, in short, one's "psycho-statical" condition, as termed by Lewes, determines these currents. Doubtless the term association would be sufficient, but inasmuch as the term apperception is in current use with reference to the interrelations between mental content and new experiences, it will be a useful one to employ.

Apperception is not a process that is operative only occasionally. But it is usually in striking instances that the process is brought to our attention. Upon reflection we at once recognize that we are continually interpreting new facts by means of ideas already in our possession. The every-day effect of feelings upon our thoughts is an exemplification. The world appears roseate to one who has slept well and dined well and upon whom fortune in general has recently smiled; but the sombre tints alone are visible to one troubled with insomnia or indigestion, or upon whom calamity has fallen. In interpreting all experiences which come to us we rely upon past experiences to give them meaning. A traveller in a foreign land gains from his travel largely in proportion to what he takes with him. A common seaman travels the world over and knows nothing of the wealth of history that may be revealed to one who reads history before going. The peasant often lives a lifetime in sight of monuments and battlefields and remains unconscious of their meanings. What would Westminster Abbey mean to an unlettered serf? A mere stone pile not different in significance from any other. His soul would remain unthrilled by the thought of the presence of the mortal remains of so many of the world's illustrious dead. To the student of the world's history there must come feelings of reverence and awe as he loses himself in imaginative contemplation

of that splendid phantom cavalcade which must pass before him in silent review. To one who comprehends, it seems, as Irving says, like stepping back into the regions of antiquity and losing one's self among the shades of former ages.

Not only does the content of the mind determine our understanding of all new ideas presented, but reciprocally the new acquisitions modify the old ideas already possessed. This process goes on so gradually that it is scarcely perceptible. We usually do not notice it until we are suddenly brought to a consciousness that we have undergone a complete revision of opinion upon some large question. We say to ourselves: "Is it possible that I ever thought that?" "How could I have believed it?" Similarly our understanding of natural phenomena undergoes change. Our moral, religious, and political beliefs are also slowly but surely metamorphosed.

Definitions.—It has readily become apparent that apperception, so far from being a distinct process, is a part of every act of perception, and also enters into every higher mental process of learning. It comprises the whole process of evaluation and assimilation. When we consider that through organic memory the effect of each acquisition is permanent and that it enters into *n*-fold relations with all preceding acquisitions, we can easily understand the meaning of apperception. The most significant definition of apperception ever given is one from the physiological point of view, formulated by Titchener. He says:[1] "An apperception is a perception whose character is determined, wholly or chiefly, by the peculiar tendencies of a nervous system, rather than by the nature of the thing perceived." Morgan said of a particular apperceptive association: "Presumably from the physiological point of view certain cortical centres, the disturbances in which are associated with this particular form of consciousness, were already in a state of irritability or incipient change, and needed only a suggestive impulse to raise their molecular thrills into dominance."[2]

[1] *A Primer of Psychology*, p. 88.
[2] *Introduction to Comparative Psychology*, p. 65.

The following definitions and descriptions of apperception may serve to throw additional light upon the question:

"Apperception may be roughly defined at first as the process of acquiring new ideas by the aid of old ideas already in the mind" (McMurry, *General Method*, p. 176).

"Whenever by an act of attention mental data are unified into a related whole, this is an act of apperception" (J. Mark Baldwin *Psychology*, p. 56).

"Every impression that comes in from without, be it a sentence which we hear, an object of vision, or an effluvium which assails our nose, no sooner enters our consciousness than it is drafted off in some determinate direction or other, making connection with the other materials already there, and finally producing what we call our reaction. The particular connections it strikes into are determined by our past experiences and the 'associations' of the present sort of impression with them" (James, *Talks to Teachers*, p. 157).

"New habits tend to become assimilated to older habits. The result is that all new events in the conscious realm tend, in consequence of the workings of the associative process, to be assimilated in type to the conscious events which have already occurred" (Royce, *Outlines of Psychology*, p. 229).

"The physician will at a glance detect in a patient symptoms which have escaped the anxious scrutiny of friends and relatives. The reason for this certainly does not lie in the greater intensity of his interest. He is able to note what they fail to note, because in his mind an apperceptive system has been organized, which they do not possess" (G. F. Stout, *Analytic Psychology*, II, p. 113).

Apperception and Heredity.—Perception is not a matter of individual experience only, but also a resultant of hereditary tendencies. That a human being can accumulate so many experiences and such complex ones is not due to individual education alone, but also to instinctive impulses and inherited predispositions. To a lower animal and to the human infant the world probably is, as James says, "one big, blooming, buzz-

ing confusion." It is either that or a dead level of monotony, because of the unmeaning signs which strike upon unattuned senses. The signs which mean so much to us fall merely as

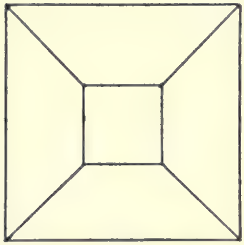

FIG. 34.—Is the large end or the small end toward you?

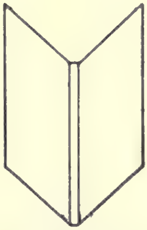

FIG. 35.—Is the book open toward you or away from you?

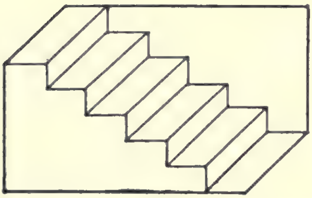

FIG. 36.—Do you see the staircase from above or from below? Try both ways.

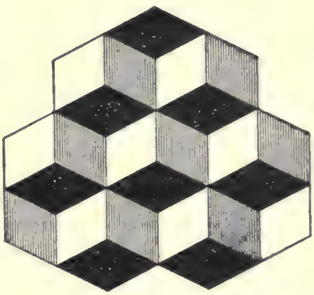

FIG. 37.—Six or seven cubes? Invert the figure.

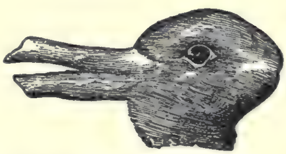

FIG. 38.—Rabbit or duck?

These five equivocal figures are copied from Jastrow, "The Mind's Eye," *Popular Science Monthly.*

sound waves upon the eye or light waves upon the ear. For example, a child of six months sees nothing in a drawing or a picture except a few blotches of color. The lines and lights

and shades do not mean anything because of his limited experience with them. So far as I am able to discern, dogs and other animals recognize nothing in a picture or a photograph. That the child eventually learns to interpret conventional lines as representing objects, while dogs do not thus learn, is a difference due to original potentiality, which makes training possible in the one case and not in the other.

Apperception and Illusions.—Every drawing or picture that we see depends upon our former experiences for its interpretation. Lines arranged in conventional ways have come through experience to mean certain things. A drawing or painting shows perspective only because we put into the representation what is not really there. Because of varied experiences we are able to see some combinations of lines and colors in different ways. If one looks at the accompanying drawing (Fig. 34) he can see either a plane figure representing two squares, one within the other, or the frustum of a cone. This latter may appear either upright or inverted. It may easily be thought of as a tunnel. The well-known equivocal figure of a book (Fig. 35), the stairs which may be seen from above or from below (Fig. 36), or the famous "six-seven" cubes (Fig. 37), all illustrate the same principle of apperception in interpreting drawings. The "rabbit or duck?" figure can be seen either way (Fig. 38), but how it is seen first, depends much upon where the attention happens to centre. In the stair-case figure the reason why it is so much easier to see the stairs from above is not because there is anything in the lines themselves that necessitate it. The representation is equally as good for stairs from below. The real reason of the mind's bias toward the other view comes from the experiences gained in the multiple number of times we have perceived the stairs from above compared with the scarcity of experiences in viewing them from below. It is even easier for us to perceive the stair-case than it is merely to see black lines.

In some cases previous associations so bias the mind that it is impossible to perceive aright what is given through sensations. We then have illusions. A few examples may be cited to illustrate.

(1) The first one is known as Aristotle's illusion. Cross the middle finger over the forefinger and place a marble or other spherical object between the two; the nose will do. Note the two marbles or noses. Why? In normal experience to touch the outside of the first and second fingers would necessitate two objects and one naturally infers whenever both are stimulated that it is accomplished by two objects. If you look at the marble the illusion will probably disappear. The eyes then contradict the skin. Try it by closing the eyes and having some one put either one thing or two things, as he chooses, between the fingers. The skin then triumphs over the eyes, and the illusion returns. (2) A string of a given length drawn slowly through the closed fingers of a blindfolded person seems much longer to him than the same string drawn through rapidly. The length of the string is judged by the length of time it is in contact with the skin. When one is blindfolded sight cannot counteract the perception gained through touch. (3) All are familiar with the illusion produced, and practically impossible to dispel, when one looks out of a car window at another train close against the one in which one is sitting. As motion is only relative, it is immaterial whether we or other objects move. So long as we personally are not producing the movement, and only the two objects are visible, it is impossible to decide which is stationary and which in motion. (4) Why does the rising full moon appear so much larger on the horizon than in the zenith? Various answers have been given, each one based upon the theory of apperception. The most satisfactory is the one which takes into account the relation between the distance of the object from the eye and the angle which it subtends. An object filling a given visual angle and thought to be far away is judged to be larger than one filling the same angle but thought to be nearer. This is true because objects of different sizes at a given distance from the eye, or a given object at varying distances produce retinal images of different sizes. The relations obtaining between these factors will be rendered clear by the accompanying diagram (Fig. 39).

Hence, in order to determine either size or distance the other factor must enter the judgment. Not always knowing these elements, the mind frequently misjudges. The judgment is usually subconscious but just as certainly affected. In fact, even though we come to know differently we cannot always remove the impression which has been built up from former experiences. (5) The sky does not seem to be the interior of a perfect hollow hemisphere, but appears flattened. This is because the space on the plane of the horizon is filled with intervening objects and

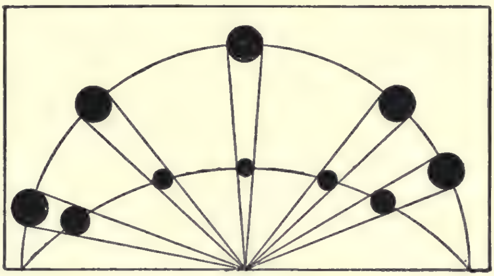

FIG. 39.—To explain the varying appearance of the size of the moon in different positions in the sky.

This figure relating to the appearance of the moon is copied from Wundt's *Grundzüge der Physiologischen Pyschologie*, II, p. 201, 4th ed.

consequently is estimated to be greater than the empty space between the observer and the zenith. (6) Objects look larger in a fog because, being dim, they seem farther away than they really are. In a clear atmosphere, like that of Colorado, objects seem nearer than they really are, and also seem smaller because they seem so near. The tenderfoot starts to walk to the foothills before breakfast, when the journey requires an all-day ride with a horse. (7) The variously estimated size of the new moon just appearing above the horizon is very interesting. One person will say that it is about as large as a silver dollar, another as large as a wash-tub, while some think it as large as the hind wheel of a wagon. (8) Le Conte[1] suggests the following ex-

[1] *Physiology and Morphology of Animals*, p. 154.

periment to enable one to realize the relation between size and distance: "Look at the setting sun steadily for a moment. The image of the sun is branded on the retina so strongly that the brand remains for some time. Now, every change in the retina, whether it be image or shadow or brand, is seen as something in the field of view. With the sun-brand still on the retina, look where we will—on the wall, on the floor, on the sky—we see a spectral image of the sun. Now as to the size. Look on a sheet of paper two feet off; the image cast on the sheet is about a quarter of an inch in diameter. Look at the wall twenty feet off; the image is a little more than two inches in diameter. Look at a building one hundred feet off; the image is about ten inches in diameter."

Persons congenitally blind acquire the habit of interpreting the qualities of external objects by means of the other senses. When operations are performed enabling them to see, they retain, frequently for a long period, the former method of apperceiving objects. Cheselden records that one youth on receiving vision for the first time at about twelve years of age "saw everything flat as in a picture, simply receiving the consciousness of the impression made upon his retina; and it was some time before he acquired the power of judging, by his sight of the real forms and distances around him." Another boy, after receiving his sight, on returning to his home went about the old familiar places shutting his eyes, though he opened them on going to new places. It was some time, however, before he came to rely upon the sense of sight for the usual knowledge.[1] Carpenter states another case described by Critchett in which a girl after being operated upon never could identify an object by sight alone, although she could make out its shape and color. "It was curious to place before her some very familiar object that she had never compared in this way, such as a pair of scissors. She would describe their shape, color, glistening metallic character, but would fail in ascertaining what they really were, until she put a finger on them, when in an instant she would name

[1] Carpenter, *Mental Physiology*, p. 180.

them, and laugh at her own stupidity, as she called it, in not having made them out before."[1] The reader will also recall the cases cited under sensory training which illustrate the same principles.

It is easy to understand how hallucinations are produced in the minds of superstitious people, especially when in lonely places at night. Their minds being full of things they "might happen to see," the wonder is not that they see so much but that they do not see more. Every streak of moonlight, every stump, every shadow, is instantly transformed into the object they have in mind. Many other illustrations of illusions due to apperception, and easily observable, will readily occur to the reader. The foregoing experiments and illustrations will serve to call attention to the part which the mind plays through its preperceptions and apperceptions in understanding the multitude of stimulations which come to us. Only those which have become signs and symbols through experience are of any significance to us. Hence, it becomes of much importance in teaching to recognize that the learner can only assimilate those facts for which the mind through its previous stock of ideas has been prepared.

EDUCATIONAL SUGGESTIONS

Proceed from Concrete to Abstract.—A study of apperception re-enforces the idea of the necessity of proceeding from the concrete to the abstract. Unless the individual elements in a concept are thoroughly understood, it is impossible to comprehend them as a totality in their complex relations. Instead of beginning with definitions, abstract principles, and laws, the meaning of them should first be made clear. Otherwise the statements are mere empty words. Every concept should have its concrete examples to which the mind can turn for illustration at any time. The child mind deals with the concrete and any education that attempts to foist abstractions upon it will produce

[1] *Op. cit.*, p. 189.

but a veneering that is sure to scale off. Much that is told pupils is so abstract and general as to be practically meaningless. Unless they can form concrete images which may be used as measures of the thing talked about the idea is hazy and fades quickly. Those ideas which have been built up either through sense-perceptions bit by bit or through imagery in much the same way are the ones that persist. We constantly appeal to the child through our own experiences instead of through his. We expect him to comprehend the complex abstractions and the conventionalities of which we speak to him in an almost unknown tongue. Christ as a teacher was far wiser. Notice how he selected his illustrations from the every-day life of his hearers. Though a carpenter himself, he never used illustrations from that occupation, but he recalled his hearers' experiences as shepherds, as husbandmen, as fishermen, etc. Illustrations leading up to great truths were always selected from experiences near at hand. He recalled the sparrow, the foxes, the lilies of the field, the seed-time and harvest, the sower who went forth to sow, the manna in the wilderness, the widow's mite, the Pharisee, and the publican—objects with which they were all familiar.

Should we not begin our instruction of children with experiences personally familiar to the particular children taught, and make the teaching radiate from those? The point of contact for the city child is of one kind and for the country child another. Imagine the city child struggling with the verse, "The Lord is my shepherd, I shall not want." The metaphor suggests imagery entirely foreign to him. Canon Tristam relates that while in missionary work in Ceylon he was once "addressing, through an interpreter, a large congregation of native Christians, and, unfortunately, chose the subject of the Good Shepherd. My interpreter told me afterward that not one of my hearers had ever seen a sheep, or knew what it was. 'How, then, did you explain what I said?' I asked. 'Oh!' he replied, 'I turned it into a buffalo that had lost its calf, and went into the jungle to find it.' This interpreter probably knew nothing of the science of teaching, and yet he had an instinctive sense of the

principle of the point of contact on the plane of experience." [1] Children appropriate words so easily that they frequently deceive others into thinking they possess real knowledge when they have absolutely no comprehension of what they are talking about. Dr. Dewey says: "While I was visiting in the city of Moline a few years ago, the superintendent told me they found many children every year who were surprised to learn that the Mississippi River in the text-book had anything to do with the stream of water flowing past their homes."

Inventory the Pupil's Knowledge.—A study of apperception presses the conclusion that before attempting to impart new instruction a careful inventory of the mind should be made. This is true not only for a new year, or a new term, but also for each day and before each lesson unit is presented. This is the object of an examination for entrance to a new class, a higher grade, or a new school. It is necessary to know whether the pupils are prepared for the new instruction to be given. Although this is usually done in a general way, it would be advantageous if much more attention were given to determining the mental attitude of every class which an instructor meets for the first time. This is true whether in the kindergarten or the university. It is the height of pedagogic absurdity for a teacher to start lecturing and continue lecturing for weeks and months without affording an opportunity for the listeners to disclose their fitness for listening. The search for the condition of the learners need not be formal, but some sufficient opportunity for reaction individually and collectively should be afforded.

Individual Differences.—In the primary grades a large proportion of the time should be devoted to studying the exact status of each individual in the class. In every group of forty first-grade pupils entering in September there are ordinarily ten per cent. who do not need to remain in that grade a month. Another twenty-five per cent. could be promoted or at least should be separated from the rest by the middle of the year.

[1] Du Bois, *The Point of Contact in Teaching*, p. 91.

CHILDREN'S IGNORANCE OF COMMON THINGS

NAME OF OBJECT OF CONCEPTION	PER CENT. OF CHILDREN IGNORANT OF IT		
	IN BOSTON	IN KANSAS CITY	
		WHITE	COLORED
Beehive	80.0	59.4	66.0
Crow	77.0	47.3	59.0
Ant	65.5	21.5	19.1
Squirrel	63.0	15.0	4.2
Robin	60.5	30.6	10.6
Sparrow	57.5	....	....
Sheep	54.0	3.5	....
Bee	52.0	7.3	4.2
Frog	50.0	2.7	....
Pig	47.5	1.7	....
Chicken	33.5	0.5	....
Worm	22.0	.5	....
Butterfly	20.5	.5	....
Hen	19.0	.1	....
Cow	18.5	5.2	....
Growing wheat	92.5	23.4	66.0
Elm	91.5	52.4	89.8
Oak	87.0	62.2	58.6
Pine	87.0	65.6	87.2
Maple	83.0	31.2	80.8
Growing moss	81.5	30.7	42.5
" strawberries	78.5	26.5	1.1
" clover	74.0	....	....
" beans	71.5	....	....
" corn	65.5	....	....
" potatoes	61.0	....	....
" apples	21.0	....	....
" dandelion	52.0	....	....
Knows:			
Right and left hand	21.5	1.0	10.2
Cheek	18.0	.5	....
Forehead	15.0	.5	....
Throat	13.5	1.1	....
Knee	7.0	1.6	....
Stomach	6.0	27.2	45.9
Season	75.5	31.8	56.1
Seen:			
Dew	78.0	39.1	70.2
Hail	73.0	13.6	18.1
Rainbow	65.0	10.3	2.1
Sunrise	56.5	16.6	....
Sunset	53.5	19.5	....
Clouds	35.0	7.3	....

CHILDREN'S IGNORANCE OF COMMON THINGS

NAME OF OBJECT OF CONCEPTION	PER CENT. OF CHILDREN IGNORANT OF IT		
	IN BOSTON	IN KANSAS CITY	
		WHITE	COLORED
Moon	7.0	26.0	53.0
Stars	14.0	3.0	....
Conception of:			
Island	87.5	....	....
Beach	55.0	....	....
Woods	53.5	....	....
River	48.0	....	....
Pond	40.0	....	....
Hill	28.0	....	....
Brook	15.0	....	....
Triangle	92.0	....	....
Square	56.0	....	....
Circle	35.0	....	....
Five	28.5	....	....
Four	17.0	....	....
Three	8.0	....	....
Seen at work:			
Watchmaker	68.0	30.1	49.7
Bricklayer	44.5	10.1	2.1
Shoemaker	25.0	8.7	....
Seen:			
File	65.0	20.8	36.1
Plough	64.5	13.9	8.5
Spade	62.0	7.3	15.0
Hoe	61.0	5.0	10.6
Axe	12.0	18.4	53.0
Knows by name:			
Green	15.0	....	....
Yellow	13.5	....	....
Blue	14.0	....	....
Red	9.0	....	....
Origin of:			
Leather	93.4	50.8	72.3
Cotton Goods	90.0	35.7	15.0
Flour	89.0	34.7	57.4
Bricks	81.1	33.1	53.0
Woolen Goods	69.0	55.0	44.0
Butter	50.5	6.7	....
Meat	48.0	8.3	12.7
Milk	20.5	4.0	....
Knows:			
Shape of world	70.3	46.0	47.0

Another group will need special attention and will not be ready to go on even at the end of the year. But how often the September consignment is bunched together, once for all, labelled, put through the same process, pressed, pushed, pulled, ground, and stretched, until they appear uniform, and are ready to be ticketed and passed on to the next grade or department. Thus they stay together except as death or disgust separates them. No fact of modern psychology is more important than that there are countless individual differences which must be recognized in all good teaching. These differences must be sought and individuals ministered to accordingly.

In 1869 an investigation was carried on in the schools of Berlin to discover the individuality of children entering the city schools. It was believed that the varying environment of the different children would be reflected in the differing ideas of the children. The investigators were, however, not prepared for the striking differences which appeared in the returns. They found that many were ignorant of the commonest objects in their environment, while others manifested knowledge far superior to anything anticipated. This investigation has indirectly stimulated a great many others of a similar nature. The classic among studies in this line is the one undertaken by Dr. G. Stanley Hall in 1880, in the primary schools of Boston. He had the co-operation of Superintendent Seaver and the painstaking assistance of four trained kindergartners. These trained women were employed by the hour to question the children in groups of three. This individual method enabled them to test ideas in a great variety of ways. By this means they eliminated the inaccuracies which might easily arise from a lack of words or through a confusion of terminology. Precautions were taken to avoid schools where the children came from homes representing extremes of either culture or ignorance. Statistics were secured from about 200 children. In 1883, shortly after Dr. Hall's study was published, Superintendent Greenwood, of Kansas City, tested with a part of Dr. Hall's questions 678 children from the lowest primary class in that city. Of the children

tested, 47 were colored. Because of the great importance which these studies have assumed extended quotations are made from the tables and from Dr. Hall's comments.[1]

Dr. Hall says that from the foregoing tables "it seems not too much to infer: (1) That there is next to nothing of pedagogic value the knowledge of which it is safe to assume at the outset of school-life. Hence the need of objects and the danger of books and word cram. Hence many of the best primary teachers in Germany spend from two to four or even six months in talking of objects and drawing them before any beginning of what we till lately have regarded as primary-school work. (2) The best preparation parents can give their children for good school-training is to make them acquainted with natural objects, especially with the sights and sounds of the country, and send them to good and hygienic, as distinct from the most fashionable, kindergartens. (3) Every teacher on starting with a new class or in a new locality, to make sure that his efforts along some lines are not utterly lost, should undertake to explore carefully section by section the children's minds with all the tact and ingenuity he can command and acquire, to determine exactly what is already shown; and every normal-school pupil should undertake work of the same kind as an essential part of his training. (4) The concepts which are most common in the children of a given locality are the earliest to be acquired, while the rarer ones are later."

It should not be understood that the tables are to be regarded as supplying averages which will measure the knowledge that all children of corresponding ages ought to possess. The facts contained in the table are designed to show, first, how poorly children frequently understand terms that are used in their earliest instruction; second, that it is absolutely necessary to ascertain what the child has as capital before beginning to instruct him in new things; third, to show what great differences there are among children surrounded by different conditions.

[1] "The Contents of Children's Minds on Entering School," *Pedagogical Seminary*, I : 139–173.

The differences shown for children in different cities are typical of the differences that could easily be found among individual children in the same community or even in the same family. Though environed by the same conditions, different children appropriate or assimilate them differently. The individual child must be studied and ministered unto. A study of the apperceptive contents of various minds reveals the necessity of emphasizing individual psychology in education much more than has been done.

Apperception and Reading.—One main reason why pupils often fail to appreciate literature is that they are given material which relates to ideas which they never have experienced. During childhood and youth they are frequently assigned literature dealing with adult philosophy. The whole periods of childhood and youth are thus slurred over and the instincts of those periods sinned against by not offering them more material suitable for the nourishment of immature minds. To indicate what is suitable for each age is difficult and we have but begun to make a scientific selection and adaptation. In fact it is doubtful whether much good literature for childhood has been written. Serious attempts are being made to produce books on history, biography, travel, and science that will interest, instruct, and arouse pupils of different ages, but from a recent extended examination of hundreds of books submitted by various publishing houses in competition for a place in a State school library list, I am led to believe that there are published tons of undesirable material to pounds of suitable material.

Robinson Crusoe, certain selections from Robert Louis Stevenson and Eugene Field, special selections from the Bible, and some fairy stories and folk-lore appeal to children because the language and the meaning are both simple enough to be interpreted through childish experiences. But even many selections from Field and Stevenson, though using children as characters, deal with a philosophy of life so profound that children get no inkling of meaning from them. They deal with children as seen by adults and not as children see themselves. Miss Alcott and

some others have been singularly happy in appealing to children by revealing childhood without being childish. It is very doubtful whether many fairy stories appeal to children so much because understood as because they possess a weird fascination. The horrible in literature may fascinate the child as a snake may fascinate a bird. But the interest may be painful. The sanguinary fairy story may hold the child much as murder recitals and other sensational stuff in the daily papers fascinate the multitudes. To say that therefore they are the best, however, is an unwarranted conclusion.

The adolescent period with its own peculiar instincts blossoming out furnishes an apperceptive background which must be comprehended and heeded else all literary instruction furnished will miscarry. A wealth of hitherto dormant impulses, emotional and intellectual, now furnish both a motive for unexplainable activities and also that attitude which causes them to vibrate in sympathetic unison with the ideals represented in certain types of literature. Apperception masses, as before intimated, are not only individual acquisitions, but racial. The suddenly widened interests caused by newly developed instincts and enlarged experience necessitate a wide range and variety of literature. To name all kinds demanded at that time is unnecessary and impossible. A few suggestions may be of some service. Dr. Hall writes:[1] "On entering the high school the average child has essentially passed the stage of juvenile reading. Animal, detective, wildly romantic, and outlaw themes are on the wane, but there is a rapid rise of the curve of normal interest in travel, biography, exploration, adventure, literature with abundant action, perhaps dramatic, but always somewhat exciting and adventurous. Every census, now scores in all, shows that in the early teens there is for the average child something of a reading craze, as if now for the first time the mind took flight in the world of books. . . . It is, however, the reading of the prospector and not of the miner, the age of skipping and sampling and pressing the keys lightly, until something absorb-

[1] *Pedagogical Seminary*, 9 : 99.

ing is found that feeds the soul. Girls, who always read most poetry, not only like most that boys do, but exceed them in preference for books by women authors, which boys eschew, also in those which centre in domestic life and with children in them." Chubb says:[1] "The quickly budding instincts . . . must get a chance to deploy themselves and reveal their significance. . . . In our choice of literature we must accommodate ourselves to certain marked changes that overtake the boy and girl during the four years of high-school life. For instance, it ought to meet and form and exalt the nascent sex-consciousness by literature that touches nobly and simply the theme of romantic love, and presents healthy and formative types of manhood and womanhood. It ought to provide food and outlet for the religious and ethical instincts that mature during what is preeminently the period of 'conversions,' as the psychologists tell us. It ought to feed that feeling for Nature which one statistician records as the most universal of the emotions of youth. And it ought to cater mildly to those sudden, and also generally short-lived, 'crazes' for different forms of art, music, acting, etc., which are manifestations of a quickened sensitiveness to beauty."

Besides the racial apperceptions in the form of instincts and impulses, there are innumerable personal peculiarities which should be taken into account. Individual acquisitions are as varied as the number of individuals. Considering heredity and environment as determinants in producing a given type of mind we see that the number of permutations is endless. Hence the necessity of studying each individual in order at least to discover and minister to some of his more important needs. The stock of ideas of the country boy will differ radically from that of the denizen of the city. In many cases, of course, an adequate apperceptive basis for the study of a given selection could be built up by proper preparation. It would be a safe rule that no selection should be studied unless the pupils had an experimental basis for apperception, or by proper preparation might secure such.

[1] *The Teaching of English*, p. 242.

Baker observes[1] that "If, as has been asserted, the power to form the picture is the condition of enjoyment of the scene, we must take account of the stock of memories which the pupils have and out of which they are to make the new picture. Obviously there are wide differences in their mental outfits. The observant country boy would need no help to see Whittier's *Barefoot Boy* or Bryant's *Waterfowl* except the stimulating questions of the teacher. But the ocean to an untravelled inland boy, or the scenes of *Snow Bound* to a Southern boy, would be very vague. So the wild mountain scenery of Scott, or the masterpieces of art, or the scenes of conflict involving long-past customs and accoutrements, may lose much of their vividness for lack of a background of appropriate memories. It is here that the importance of illustrative material appears." Bullock concluded from an investigation[2] that war stories seem popular with third-grade boys, and that liking seems well marked through the sixth, seventh, and eighth grades. Stories of adventure are popular all through the heroic period, reaching their maximum in the eighth and ninth grades. The liking for biography and travel or exploration grows gradually to a climax in the ninth grade, and remains well up through the course. The tender sentiment has little charm for the average grade boy, and only in the high-school course does he acknowledge any considerable use of love stories. In the sixth grade he is fond of detective stories, but they lose their charm for him as he grows older. For girls, stories of adventure are popular in the sixth grade, and stories of travel are always enjoyed. "The girl likes biography, but in the high school, true to her sex, she prefers stories of great women rather than great men," but, according to Hall, because she cannot get them reads those of men. Kirkpatrick says:[3] "The fact that boys read about twice as much history and travel as girls and only about two-thirds as much poetry and stories shows beyond question that the emotional and intellectual wants

[1] *The Teaching of English*, p. 170.
[2] *Some Observations on Children's Reading*, Proc. N. E. A., 1897, p. 1015.
[3] *Northwestern Monthly*, 9 : 229.

of boys and girls are essentially different before sexual maturity."[1] Dr. Hall deprecates the fact that the English teaching of the present apotheosizes form, stresses philological ramifications and syntactical relations, and gives such a barren waste of literary content. Adolescents need above all a wide field of virile literature to secure for them the deepest self-revelation.

Apperception and Geography.—The absolute necessity of interpreting that which is new, strange, and foreign in terms of familiar, well-digested ideas suggests definitely the psychological order of procedure in teaching geography. Although the ultimate aim in teaching geography should be to awaken an interest in and an understanding of that which is beyond the sweep of the physical eye, yet children will ever see through a glass darkly unless that which is to be constructed in imagery has first been made possible through experience. Moreover a desire to part the curtain which veils the unknown must be developed out of some personal interest. Otherwise everything is learned in a purely perfunctory way. Interest is absolutely dependent on apperceptive knowledge. A white heat of interest is never kindled for anything except through a mind brimfull of combustible ideas connected with it.

Geography like charity must begin at home. The Germans have developed home geography teaching in a way that should be emulated everywhere. It is no unusual sight to see a teacher conducting a class of thirty or forty pupils on a half-day's excursion. The whole troop generally have their knapsacks containing luncheon and note-books. They go to places of historical and geographical interest, they see objects of natural science, etc. The teacher explains; the pupils question, make notes and drawings, gather specimens, and in every way gain first-hand impressions of the vicinity. These lessons form the basis for further discussions, recitations, and language lessons. They are supplemented by additional talks, collateral readings, and are stored away as the genuine basis from which new knowledge

[1] See Hall's *Adolescence*, II, p. 475, *et seq.*, for further quotations and observations.

radiates. Each lesson is preceded by a careful preparation for what they are to see. This prevents desultoriness. Frequently older boys of a school are taken by a teacher upon excursions lasting a week.

Apperception in History and Civics.—Historical teaching to be well done must similarly consider the laws of apperception. A chronological order would dictate commencing at the beginning of things and tracing events in an orderly time-sequence. A logical or philosophical order would necessitate a consideration of causes and effects. But logical and chronological sequences are frequently unpsychological from the teaching stand-point. The child's ability to comprehend and his interest are the only safe guides. The latter is, as previously noted, largely conditioned by the former. Especially in the earlier stages of the course the pupil must be given such facts of history as can be comprehended and as inspire interest in historical study. The order of the books matters little. What boots it if we present the story of Alexander the Great to-day, George Washington to-morrow, and Napoleon the next day, or whether the order be reversed, provided the above conditions have been observed? There will come a time in later historical study when the chronological and institutional order will need to be followed if the student is to be versed in systematic history. But in the beginning the child is unprepared for it. Logically and chronologically the child in the elementary school should begin with ancient history. But how absurd to attempt to teach it that way. The Russo-Japanese war, the freeing of Cuba and the Philippines are much better psychological starting points. The blowing up of the *Maine* and Hobson's spectacular heroism are much more apt to stir the emotions and be studied carefully by present-day American boys than are the bravery of Leonidas at the Pass of Thermopylæ or the Peloponnesian Wars.

Not a few grammar-school boys and girls possess as comprehensive and accurate knowledge of the history-making events of the day as do their elders. The occurrences come so close to

them in time and interest that they study them as a matter of course. This suggests the correct method of beginning history. Those events which have a local and a personal relation are the ones to choose first. Deeper causes of these will be desired eventually and when some of the effects are known there will be interest in causes. This may seem illogical, but effects always lend interest to causes. The recent San Francisco and Messina disasters stimulated more interest in causes of earthquakes than had been manifested in many a day. Before studying the historical town-meeting in New England, why not develop a background of interest and understanding by becoming acquainted with the town-meeting as exemplified on every hand? There is little doubt that we are annually disgusting thousands of boys and girls with history by attempting to make it ultra-systematic and philosophic. Let us grant that our own civic and social life and its evolution cannot be completely understood without knowing its relation to English and Continental history. But we are over-zealous to make boys and girls interested in the evolution of things they do not even know. The first problem is to give them an insight into that life, knowing that they may then become interested in its origins. Too often they are plunged into ancient history details which to them are isolated and devoid of meaning. Even the names repel by their strangeness. A large fund of information must be acquired, just because it is interesting, before we attempt to systematize it. This stock of ideas will form an apperceiving mass for the systematic relations which we trust they will be led to perceive. But hyper-system without basal facts is infinitely worse than a jumble of facts unorganized.

The study of civic, economic, and social conditions must likewise be begun in a thoroughly concrete way. Instead of starting with books and forcing undigested theories and formulas upon minds inexperienced in observing social relations, the teacher should skilfully lead his pupils to observe the workings of the facts and forces about them. Every community offers a rich variety for study. All the social, economic, and civic relations

may be studied objectively and should be so studied before the abstract book theories are studied. Too often pupils can recite verbatim the United States Constitution and answer (frequently incorrectly) some unusual question in constitutional law, but are entirely innocent of any real knowledge of the government of the municipality or the township in which they reside. They do not know the phases of government represented or the functions assumed. They do not perhaps know of the existence, much less the manner of organizing, primaries and caucuses. They do not know the sources of support for their public schools, post-offices, streets, water-works, etc. By studying the actual workings of the several public agencies and utilities in the concrete they can build up a background of experience which will enable them to understand theoretical discussions and abstract principles.

Adolescent expansion and groping of the mind suggest the necessity of this very method. Here and there we discern a recognition of this concreteness and the necessity for building up an experimental apperception mass. Professor Thurston, for years an instructor in the Hyde Park high school, Chicago, has long "earnestly believed that a beginner in economics had a right to find the subject closely related to his own experience, and that of his neighbors, so that he would seem to himself to be studying the industrial life of actual men and women more than books about this industrial life."[1] The same plan is applicable to the study of civics in a wider sense. By any other method than the gathering of concrete experiental facts preliminary to theories, pupils gain only dry, meaningless abstractions; they have only prattlings about civic duties and relations, and know nothing of the real concerns of actual life as it pulsates and throbs about them.

Opportunity for Application of Knowledge.—Knowledge to be made useful must be applied. It is frequently indefinite until it has been applied to new and concrete situations. One is not master of a mathematical principle until he has tested it in a

[1] *Economics and Industrial History for Secondary Schools*, p. 7.

specific case. The engineer who cannot put his theories into practice has only partially learned his lessons. The physician who does not know how to prescribe in individual cases would not be counted either learned or skilful. Skill is at once seen to be a part of knowledge. In fact complete accuracy is lacking until some skill is acquired in the use of facts. Hence knowledge to become of greatest apperceptive value must become of constant use so that its relations instantly come into view when needed. An interpreter away on a vacation would be of little use to one in a critical situation. Similarly knowledge which might be of use could it only be marshalled, but so vague that it requires an hour's hunt to bring it into requisition is of small value. We are constantly saying: "Of course, I might have known, but it didn't occur to me!" Facts which were in possession should have been of use in evaluating the new condition, but they had not become habitual accompaniments of our thinking. The man with usable knowledge is the man of power.

Apperception and Interest.—One of the most fundamental factors in the development of interest in any given thing is a stock of ideas which enables the mind to go out to meet the incoming stimuli. Interest is an attitude of the mind toward definite objects of thought. It is impossible to have a deep and abiding interest in anything about which absolutely nothing is known. Sometimes the attention is momentarily arrested by utterly strange things; but unless we can find out something about it the curiosity wanes. Miners frequently dig out thousands of fossil remains of small animals and occasionally those of mastodon proportions. Their attention is diverted momentarily because of the unlikeness to the coal or other deposits, but after the most trivial observation they are consigned to the dumps. How differently would the geologist behave!

Parkman, in describing the Indians of Fort Laramie, gives an excellent illustration showing that interest is developed only through knowledge. He says that the Indians "were bent on inspecting everything in the room; our equipments and our

dress alike underwent their scrutiny; for though the contrary has been carelessly asserted, few beings have more curiosity than Indians in regard to subjects within their ordinary range of thought. As to other matters, indeed, they seemed utterly indifferent. They will not trouble themselves to inquire into what they cannot comprehend, but are quite contented to place their hands over their mouths in token of wonder, and exclaim that it is 'great medicine!' With this comprehensive solution an Indian is never at a loss. He never launches forth into speculation and conjecture; his reason moves in its beaten track. His soul is dormant; and no exertion of the missionaries, Jesuit or Puritan, of the Old World or of the New, has as yet availed to rouse it." [1] When the Fiji Islanders first beheld some foreign merchantmen they viewed them with superstitious awe, but with no curiosity. But when some of the small boats were lowered they instantly became alive with interest. Similarly, some Eskimos, we are told, on being taken to London to view the sights and receive a great treat were interested in nothing, but were filled with disgust, which was overcome only when they accidentally came upon some boats and fishing tackle that resembled products of their own manufacture.[2]

James says: "The great maxim in pedagogy is to knit every new piece of knowledge on to a pre-existing curiosity—*i. e.*, to assimilate its matter in some way to what is already known." He illustrates the advantage of comparing the unknown with the personal experience of the pupil by the following example drawn from Lange's *Apperception.* "If the teacher is to explain the distance of the sun from the earth, let him ask . . . 'If anyone there in the sun fired off a cannon straight at you, what should you do?' 'Get out of the way,' would be the answer. 'No need of that,' the teacher might reply. 'You may quietly go to sleep in your room, and get up again, you may wait till your con-

[1] *California and Oregon Trail,* chap. IX.

[2] The relation between interest and apperception is more fully discussed in the chapter on Interest.

firmation-day, you may learn a trade, and grow as old as I am—*then* only will the cannon-ball be getting near, *then* you may jump to one side! See, so great as that is the sun's distance!'" [1]

Frank G. Carpenter, in his delightful *Geographical Reader on North America*,[2] has given a splendid example of teaching by appealing to the child's "apperceptive mass" in building up a new concept. Writing of the great corn crop raised in the seven States of the corn belt, he says: "This is the greatest corn patch on the globe. It produces more than one billion bushels of corn every year, or more than one-half of our crop. Now let us think for a moment how much corn one billion bushels is. Suppose we load it upon wagons. Forty bushels of shelled corn forms a good load for two horses. Let each wagon hold that amount, and let the teams start at the Mississippi River and go eastward. We shall drive the teams so that the nose of each horse will just reach the tailboard of the wagon in front of it, making a continuous train of wagons, each loaded with forty bushels of corn. Now, where would the first wagon be when the last bushel was loaded? At Pittsburg, on the edge of the Alleghany Mountains? No; it would be much farther eastward. At the Atlantic Ocean? No; still farther eastward. Suppose that the wagons could be driven across the oceans, and guess again. It might perhaps reach almost to Paris, do I hear some one say? Yes; it would reach, on and on, much farther than that. The line of wagons would extend from the Mississippi over our own country to the Atlantic Ocean, across the Atlantic to Europe, across Europe and over the highlands of Asia, and then across the wide Pacific Ocean. It would not stop there, but would climb over the plateaus and peaks of the Rocky Mountains, and come back to you at the Mississippi River, making a solid belt of corn-wagons clear round the world. But stop! we have not yet loaded all of the corn crop of these seven States. The pile seems almost as big as when we began. There are five times as much corn left as that we have put on the wagons, and we should

[1] James, *Psychology, Briefer Course*, p. 328.
[2] Pp. 161–163.

have to make six such lines around the world before we could load a single year's crop of this great corn patch. It would take so many wagons, indeed, that if they were stretched out in one single file, the first wagon would be more than one hundred and fifty thousand miles away before the last wagon was loaded. And yet these seven States contain only about one-half of the corn we produce, and you must multiply the number of wagons by two if you wish to know how many would be needed to carry one year's corn crop of the whole United States."

Apperception and Arrangement of Curriculum.—The application of knowledge is peculiarly dependent upon the arrangement of the course of study. The course should be so arranged that each topic in each subject may be naturally retraced—of course, from a different point of view. This procedure, termed the spiral plan, is largely observed in the German schools. They aim to have every subject before the mind of the pupil for a great many years. Instead of taking algebra, for example, for a year and finishing it, the subject is begun at about eleven years of age and carried until eighteen or twenty. The same is true of geometry. Trigonometry is begun at about fourteen and carried four or five years. History is pursued two hours a week for six or eight years instead of five hours a week for a couple of years. From personal inspection I know that the final resultant is much better than in our schools. By the German plan pupils are enabled to begin the elementary consideration of so-called secondary school subjects at an early age, reserving the more difficult portions until their minds are ready to grasp them. Easy algebraic processes are taken before difficult arithmetical problems; the introduction to geometry is made early and its results utilized in later arithmetical problems. Logarithms are studied at thirteen and the tables used constantly. Thus a habit is formed and the process remembered in such a way as to be serviceable. When the study of logarithms and trigonometry is deferred until the college course the knowledge of them goes into disuse soon after acquirement. I know this to be true from a wide census taken in college classes.

Contrary to some unfounded suppositions, interest is not sacrificed by the spiral plan. Each time that ground is recrossed it is with a different purpose. For example, in elementary history the facts should be studied for their interest as facts. Later the same facts should be studied with a view to securing a more orderly sequence, and later from the institutional or philosophical point of view. In literature the reading of all of Dickens's works simply because they fascinate is a very profitable occupation, but the attitude is entirely different from that manifested in literary criticism. The former consideration should be the antecedent of the latter.

Apperception and Correlation.—Careful correlation of work in the curriculum is a great means of economy and an aid to the clearer understanding of each of the subjects. It is quite usual for subjects to be so taught that each one appears entirely unrelated to all the others. Herbart wrote: "I cannot refrain from wondering what sort of a process is being worked out in the heads of schoolboys who, in a single forenoon, are driven through a series of heterogeneous lessons, each one of which, on the following day, at the regular tap of the bell, is repeated and continued. Is it expected that these boys will bring into relation with one another and with the thoughts of the playground the different threads of thought there spun? There are educators and teachers who, with marvellous confidence, presuppose just this, and in consequence trouble themselves no further."

While the greatest value of Latin to the ordinary student should be its enrichment of the number and content of English words, yet from wide observation I know that many pupils get little appreciation of its relation to English. This is especially true where the Roman pronunciation is followed. Where grammar and ability to translate are the centre and circumference of Latin teaching, the value for English in the ordinary high-school course is relatively very small. Geography and history are seldom correlated as they should be. English is too often relegated to a special formal exercise and entirely neglected in all other subjects. While it should be the chief subject for many years,

two-thirds of the time given to it should be in connection with other subjects. Practically every composition should grow naturally out of the work in history, geography, reading, science, etc. There is seldom necessity for a "class in composition," unless it may be for criticism of the work submitted in connection with other subjects. Furthermore, all language forms learned in the separate language class must be re-enforced and drilled upon in all the other classes. It is absurd to expect that the language class can cure all the ills of incorrect speech if the faults are passed over unnoticed in the other work.

In the presentation of successive topics in a subject and in the several subjects in the curriculum constant effort should be made to have each new thing related to other acquisitions. It is only in this way that knowledge becomes permanent and vital. There is no necessity for hunting a subject which is to become a "centre of correlation." Any idea which is worth while to acquire should become a centre of correlation. The mind itself is the true centre of correlation. The teacher should study the learner's mind to know what is there and then seek to relate all new additions to the pre-existing complex. One great objection against specialists in elementary and high schools is that each one is ignorant of all that the others do. This need not be so.

In attempting to correlate the child's experiences the home activities should not be overlooked. The bulk of the child's best and most significant experiences are secured at home. Most of his concrete ideas of geography, plant and animal life, geological phenomena, physical, chemical, and meteorological laws, have been gained outside the school. The formal study of these subjects should draw heavily upon those experiences, both for the purpose of enlarging those ideas and giving them significance and for the purpose of using them in the acquisition of the new. "The branches of learning taught to the child by the schoolmaster are necessarily dry and juiceless if they are not thus brought into relation with the child's world of experience. Almost all of the school reforms that have been proposed in the past one hundred years have moved in this line. The effort to

seize upon the child's interest and make it the agency for progress has formed the essential feature in each."[1]

Concrete ideas of conduct and morality are almost wholly extra-school acquisitions. Hence the importance of interpreting these and giving the best ideals to be carried in turn into the life outside the school-room. Were the great object-lessons in conduct as exemplified in the great world about the child what they should be, there would be little difficulty in impressing the highest ideals on children. The entire process of education should be so interwoven that each part derives new meaning from all the others. Furthermore all formal processes of education should be so ultimately related to life and character that each factor may contribute to the best development of the ideal character. No item should enter into education which cannot find intimate relation with the life and character of the particular individual. The more intimately the learner can feel the educative processes entering into and contributing to his interest the more educative the processes are.

Not only is proper correlation necessary if mental economy is to be secured, but it has become a practical necessity in the administration of present-day curricula. With the enlarged range of human activities there has arisen a great multiplication of subjects, all of which have a legitimate claim for a place in the school-room. If proper correlation of subjects is made and unnecessary details which bear no relation to present-day life interests are omitted there need be no complaint about the overloading of school courses. The great trouble has been that it has been thought that all the new subjects must be introduced and at the same time all the old ones superstitiously retained. In arithmetic, for example, items of knowledge which were of practical value two hundred years ago in the business methods of the time are still required of boys in school. English grammar is largely made up of relics of Latin grammar, useful enough in connection with Latin, but of no earthly use in learning practical English. Geography is frequently a pedagogical sausage

[1] W. T. Harris, Preface to *Uncle Robert's Geography.*

composed of scraps of useless information of uncertain reliability. With proper correlation and elimination there will be sufficient room for every desirable subject and adequate time for its proper acquisition and assimilation.[1]

Reviews.—Some writers advise calling up as many related ideas as possible, but this would lead to endless detail and repetition. Only those ideas which are requisite to a full and ready comprehension of the new ideas are necessary or desirable. For example, in teaching addition of compound numbers the only processes which need conscious recall are those related to the decimal notation. The whole subject of integral addition, subtraction, division, etc., might be called up, but it would only lead away from the principle in hand. Reviews of the right sort are made imperative if the laws of apperception are heeded. The real review is more than repetition. Simple repetition is needed, of course, in purely mechanical processes like writing, spelling, dancing, gaining skill in multiplying, and adding. But in all exercises requiring serious thought the review should be a *re*-view, a *re*-seeing from a different stand-point. Conducted in this way new views are gained, and no review is worthy the name that does not give new insight and new associations. Reviews thus enlarge concepts and add to the comprehension of the topic. The review should be the period of most rapid advance as well as the time of most conscious illumination.

As was shown in discussing memory, the best method of insuring permanence of mental possessions is to bind them together with as many bonds of association as possible. The greater the number of associations the more opportunities for grasping new relations. The Herbartians have set forth the necessity of recognizing five fundamental steps in the acquisition and assimilation of all knowledge. They are (1) preparation, (2) presentation, (3) assimilation, (4) generalization, (5) application. Without assuming a formal recognition of these in every lesson, we must

[1] For an excellent article upon desirable elimination, see F. M. McMurry, *Educational Review*, 27 : 478–493 (1904).

recognize them as the general natural mental movements in the acquisition of every lesson unit.

This preparation consists in part in recalling to the mind those facts and principles which are so related to the new material as to be absolutely indispensable to its ready comprehension and assimilation. Oftentimes new processes are stumbled over in a blind way when a little attention to reviewing previously-learned related ideas would make the whole matter a delight. This is especially true in mathematics where each step depends so absolutely upon preceding processes. In the transformation of trigonometric equations how necessary that the whole previous substructure flash into the mind in order to proceed intelligently. The same is true in studying a foreign language. Not only should the prerequisite facts and principles be comprehended, but they should be so mastered that they are instantly applicable in new relations. Weeks of precious time are wasted every year in most schools because fundamental processes of *thought and expression* have not become convertible into elements of new processes. The multiplication table, the addition table, the subtraction table, various fractional equivalences, the spelling of words, the mechanics of reading, etc., must be so learned that the results are always available. The teacher who tells a child to think hard when he is asked to give the answers to such expressions as 7×9, $8 + 7$, $63 \div 7$, etc., is not doing good teaching. The child must *not stop to think*. The process must have become automatic. Likewise the meanings of words representing fundamental concepts must be made not only comprehensible but usable.

Apperception vs. Formal Discipline.—It is frequently said that it makes little difference what a pupil studies so long as he does steady, hard work. The discipline coming from the work is the all-important thing. The fact of the apperceptive growth of the mind entirely disproves this. McMurry has made a most important observation with reference to the value of previous knowledge and against the disciplinary theory of study.[1] He

[1] *Elements of General Method*, p. 280.

observes that "If knowledge once acquired is so valuable, we are, first of all, urged to make the acquisition permanent. Thorough mastery and frequent reviews are necessary to make knowledge stick. Careless and superficial study is injurious. It is sometimes carelessly remarked by those who are supposed to be wise in educational doctrine, that it makes no difference how much we forget, if we only have proper drill and training to study. But viewed in the light of apperception, acquired knowledge should be retained and used, for it unlocks the door to more knowledge. Thorough mastery and retention of the elements of knowledge in the different branches is the only solid road to progress. In this connection we can see the importance of learning only what is worth remembering, what will prove a valuable treasure in future study. In the selection of materials for school studies, therefore, we must keep in mind knowledge which, as Comenius says, is of solid utility. Knowledge which is thus useful is in itself a strong element of power, because it is a direct means of interpreting and mastering the world. Much of the knowledge gained in schools for mere disciplinary purposes is not, in the apperceptive sense, a source of power. It may be, indeed, mere pedantry and pretence, and even self-deception. The doctrine of apperception has laid the axe to the root of that ancient tree known as pure formal discipline."

Apperception and Sympathy.—The main reason why people are so unsympathetic with each other is that they do not understand each other's point of view. It is a difficult thing to put ourselves in the other fellow's place and to view the world from his elevation and with his glasses. Whenever we are asked to consider a question we at once mount our own observatory and turn our own glasses upon it. The labor question involving strikes and lockouts is very largely one of differences in understanding the problem of the other party concerned. Religious and political dissensions and intolerance are the result of bias produced by life-long instruction in some particular dogma. Could extended vision be afforded to the contending parties the differences would usually disappear.

It is an important function of education to establish a bond of sympathy between the child and the rest of the world. This it can accomplish only by putting the child in touch with the world. He must not only know the world of to-day, but he must also know it historically. This does not imply political history alone, but all that may be included in the development of civilization. Under modern urban conditions the child is apt to grow up wholly unacquainted with the fundamentals of industrial and commercial life. By this I mean that he sees practically nothing of raw materials and takes no part in the elemental processes of production, manufacturing, and distribution. He has knowledge of finished products only. From the time he rises in the morning until he is locked in slumber everything is furnished him "ready made." Is it any wonder that such a one on becoming an employer later in life has no sympathy with the man who ploughs the soil, the man who stokes the furnace, or the man who digs the coal from the bowels of the earth?

One of the great virtues in the education of earlier days lay in what was gained outside the school in the every-day duties of the farm and the household. All the various industrial and social occupations centred about the household life. Practically every article for food, clothing, and building was a home product. Animals grown on the farm or secured in the hunt, vegetables from the garden, cereals from the fields, berries from the wood, sugar from the maple-tree, furnished practically the entire supply of food. These were all prepared by members of the household. There were no cold-storage plants and refrigerator cars securing for every day in the year the freshest products of the remotest corners of the earth. Clothing was largely of home manufacture. The boys learned to shear the sheep which they raised, they carded the wool, and their sisters were adepts in spinning, weaving, and fashioning it into garments. Even the shoes they wore were frequently home-made from the hides which they tanned when they slaughtered the animals for the winter's supply of beef. To illuminate their houses, instead

of pressing a button, they made the tallow-dip from the animal fat which they had tried out and with wicks of their own manufacture. They carried out the processes of manufacture of dwellings, buildings, implements, vehicles, and furniture from the felling of the forest trees and sawing of the lumber, to the fine cabinet and joinery work and painting. Even the iron and steel work was frequently done by means of the farm blacksmith shop. Such work as could not be accomplished on the farm was made possible in the village shop or mill which was never closed for fear of revealing trade secrets.

Dr. Dewey says[1] that "in all this there was continual training of observation, of ingenuity, constructive imagination, of logical thought, and of the sense of reality acquired through first-hand contact with actualities. The educative forces of the domestic spinning and weaving, of the saw-mill, the grist-mill, the cooper-shop, and the blacksmith forge were continuously operative." Through this definite knowledge of a wide range of activities largely gained by participation in them a wholesome sympathy for those engaged in all sorts of labor was engendered. Those boys and girls gained a thorough appreciation of the efforts that must be put forth to master environment and cause it to minister to human needs. They developed an appreciation of the labor that must ever be the price of civilization. In our specialized society so many of the fundamental processes of producing and transforming the raw materials are hidden from the view of the modern, especially the city, youth that they naturally infer that all they ever need to do is to sit idly by, press a button, and order whatever takes their fancy. They gain no adequate idea of duty or responsibility, and can have no real appreciation of historical forces. The best history lesson a boy could possibly have would be to plough for a season in a stumpy, stony field. Educators are coming to realize the educational importance of participation in the handicrafts and household arts, and they are introducing manual training and domestic science to help offset some of the disadvantages of civilization. It will

[1] *The School and Society*, p. 24.

mean much if we can only stem the tide now going cityward and direct it backward toward the simpler rural life where children and youth can advantageously spend more of their days.

Apperception Suggests Teacher's Preparation.—A solemn duty is incumbent upon every teacher to make the most careful and minute preparation for each day's teaching. What the pupil has as capital to build upon must be determined. Likewise just what is to be taught must be minutely planned. To have once or even many times made preparation for former classes is not sufficient. The former preparation should, of course, render it unnecessary to spend as much time in getting ready. Frequently a given day's lesson is a failure, not because of lack of general preparation, but because the proper illustrations, apparatus, and devices were lacking or were not selected for that class, and for that day. Knowledge must, of course, be always on tap, but it is absolutely necessary to learn the gauge of the particular glasses to be filled. Knowledge imparted must ever be fresh, interesting, and presented as if the teacher were wholly absorbed in it himself. It must be genuinely fascinating to the teacher if he is to incite contagious zealousness. This attitude can only be evidenced by the teacher if he approaches the subject as a learner. There is nothing that will so stimulate pupils to become scholarly as to be in the continuous companionship of teachers who are growing in scholarship. On the other hand there is nothing that will kill out scholarly ambitions in young minds so much as to be with teachers who are mere echoists. "The unskilled teacher forces instruction upon the child and is angry or disheartened when he finds no intelligent response, although he never considered the previous question, whether the child already possesses the mental organ for apprehending the facts or ideas which are thrust upon him. The main principle which psychology lends to the theory of education as its starting-point is the need that all communication of new knowledge should be a development of previous knowledge. If the apperceptive system necessary for incorporating a new fact or idea does not exist, it must first be evolved before teaching can be

successful. It would seem that Socrates has the credit of being the first to insist on this point." [1]

Breadth and accuracy of scholarship besides professional training are absolutely essential to success. Even the "born teacher" must secure these or frequently be indictable for gross maladministration in office. It is a grand endowment to possess those qualities we ascribe to the born teacher—vivacity, quick insight, geniality, patience, justice, attractive personality, transparent honesty and uprightness, leadership, and all the others that could be mentioned; but without scholarship and professional training even the one superlatively blessed is unprepared for the high office of teacher—the grandiloquent platform orator to the contrary notwithstanding. Even with ample scholarship added, a great handicap remains and unpardonable blunders are inevitable unless the teacher begins under the wisest supervision. The trained teacher knows what instruction has preceded in the courses and what is to follow; he recognizes the varying stages of mental development and what will best minister to them; he is conversant with other subjects than his own, has studied out their relationships and thereby has gained perspective; he knows the laws for promoting the best mental action, and considers the demands which society will place upon the child.

Superintendent Cooley, of Chicago, said: "I think that the lower grade in the high school needs teachers who can teach the pupils as well as the subjects. . . . More teachers are trying to bring university methods into the high school than there are making such mistakes in the grades below." Superintendent Soldan, of St. Louis, said in the same discussion: "The very first step in the readjustment of the high school is to show at least one book by high-school teachers that embodies the high-school method. It is strange that the books for the common-school teachers are without equivalents in the high schools. Let them follow the example of the common-school teachers in mastering the subjects and also in mastering the pedagogics of the subjects.

[1] Stout, *Analytic Psychology*, II, p. 137.

. . . The pupils enter the high school as children. Their work in the first year, and often in the second year, is done after the ways of children, but by the time they leave the high schools they are adults in many respects. That important transition from childhood to adolescence has not been considered, so far as I know, by any high-school teacher. The course of study should be adjusted according to the principles of wise pedagogics. . . . The common-school teacher has gone beyond the mere knowledge of the subject he is to teach; he has gone to the thoughtful consideration of how these subjects should be taught to have the fullest educational influence over the children under his control." [1]

The whole work of the trained teacher contributes to the development of the pupil through utilizing all the means and instruments available. While the untrained teacher may by happy fortune contribute to one phase of development by using limited means, his efforts are liable to miscarry entirely because of untimeliness or bad methods, or he may warp the mind because of undue emphasis of the subject which he represents. Superintendent Cooley has said that the first-year class in the high school is the worst taught class in the whole system of schools. This, he says, is true because of the inexperience of the teachers, who are largely just out of college. They teach as they have been taught by methods well enough adapted to colleges, but entirely out of place in the high school. They exalt the subject and lose sight of the learners. They magnify their particular subject all out of proportion to its rights. It is well known that in colleges, and in high schools where the department system prevails, each instructor is apt to assign enough to occupy the whole time of the student. This is not an indictment of the college, but of the system which permits the employment of teachers without professional training. But most important of all, how can we expect immature, untrained teachers to assist much in developing in pupils a keen sense of duty and responsibility toward society when the teachers have had such limited

[1] *Proc. N. E. A.*, 1903, p. 184.

contact with it themselves? The teachers should have become broad-minded through varied contact with society and should be keenly alive to the best means of fostering the highest ideals in the youth.

CHAPTER XXI

MOTOR EXPRESSION IN RELATION TO EDUCATION

Expression an Index to Mind.—The only means we have of studying the mind of another is through his various expressions. Mind discloses itself to others only by expression as in talking, writing, drawing, painting, constructing machines or controlling them, etc. Efficiency of mind is judged wholly by the outward expression revealed to the view of the world. A student's knowledge of mathematics or psychology must be judged by what he says or writes; one's knowledge of art by what he can produce. We do not really know whether another can sing or play the piano until he manifests it in expression. A poetic soul is unknown until it bursts into song; an author's ability to write may properly be challenged until he gives an actual demonstration. Similarly an engineer must exhibit his skill, an architect his plan, a general his generalship, a statesman his statecraft, in some objective results. In fact, we know nothing of the perceptions, memories, emotions, reasonings, choosings, willings, hopes, joys, and sorrows, of others except as they give expression to them through some muscular activity. Another may love us ever so tenderly or hate us ever so bitterly, but unless we detect some of his outward expressions of it we are entirely oblivious of the fact. To illustrate, a man is angry. How do others know it? Solely by his expression. He may clench his fist, knit his brows, gnash his teeth, raise his arm to strike, utter an oath in a major key, if he believes himself stronger than his foe; if inferior he may whisper in impotent rage and skulk away because incapable of defence or retaliation. Another angry man might express himself in a more indirect, but not less effective manner by calling the police, waylaying his enemy,

going to war, writing articles of denunciation which would bring social reprobation upon his enemy, or waging a war of ballots which would express indignation and tend to secure retribution and reform. The enemy might be an individual or a violation of principle. Again, consider the various manifestations of fear. The child may run with breathless haste, eyes dilated, tears streaming, heart palpitating, face flushed, or it may be blanched and palsied. A mother immersed in grief over the loss of her loved little ones may be hysterical, or speak with voice trembling, quivering lips, have a pallid countenance, and be depressed almost to complete paralysis. In any case, the emotions are expressed in some form of action, sometimes decidedly external; in others more internal, repressed, and perhaps much diffused, but the only means we have of understanding them is through some form of motor expression.

Dr. Warner, a noted London physician, has written an entire volume on *Physical Expression*, which is of exceeding interest. The following quotation is to the point in connection with the foregoing thesis: "In the *adult* the objective *criteria* of *mind* are *modes* of *expression*; the expressions of the emotions, feelings, passions, thoughts are indications of the mind; and all these modes of expression have been shown to be produced by direct action of the nervous system. It is, then, admitted that conditions of the mind are directly expressed by nerve-muscular signs. This implies that some material, physical change occurs along with 'mentation,' which material change is expressed in the muscles of the body. It is this inherent physical change, thus directly expressed, which the physiologist investigates in his studies of mind." [1]

James says:[2] "The brain, so far as we understand it, is given us for practical behavior. Every current that runs into it from skin or eye or ear runs out again into muscles, glands, or viscera, and helps to adapt the animal to the environment from which the current came. It therefore generalizes and simplifies our view to treat the brain life and the mental life as having one funda-

[1] *Physical Expression*, p. 252. [2] *Talks to Teachers*, p. 26.

mental kind of purpose." He says that even the "inessential, 'unpractical' activities are themselves far more connected with our behavior and our adaptation to the environment than at first sight might appear. No truth, however abstract, is ever perceived, that will not probably at some time influence our earthly action. You must remember that, when I talk of action here, I mean action in the widest sense. I mean speech, I mean writing, I mean yeses and noes, and tendencies 'from' things and tendencies 'toward' things, and emotional determinations; and I mean them in the future as well as in the immediate present. As I talk here, and you listen, it might seem as if no action followed. You might call it a purely theoretic process, with no practical result. But it *must* have a practical result. It cannot take place at all and leave your conduct unaffected. If not to-day, then on some far future day, you will answer some question differently by reason of what you are thinking now. Some of you will be led by my words into new veins of inquiry, into reading special books. These will develop your opinion, whether for or against. That opinion will in turn be expressed, will receive criticism from others in your environment, and will affect your standing in their eyes. We cannot escape our destiny, which is practical; and even our most theoretic faculties contribute to its working out."

Motor Activity in Relation to Health or Disease.—An abundance of well-controlled movements, as exhibited in play or interesting work, are a sure sign of healthfulness—physical and mental. On the other hand an excess of unco-ordinated movements is a sure symptom of disease. We should always be suspicious of twitchings of the eye or facial muscles, unsteadiness of the body, head, hand, or fingers, or of stammering and stuttering. Likewise we should study closely the child who drums incessantly with the fingers or the feet, who is restless, constantly changing position to no purpose, rolling the eyeballs, or drooping the head; whose arms hang limp by the side, who drags his feet and stumbles; who cannot throw a ball, run, trundle a hoop, etc. Such a child is either fatigued, has not slept suffi-

ciently, or is ill-nourished. Children are often excitable, passionate, melancholy, and fretful. During sleep such children are seldom in repose; they grind the teeth, are troubled by incessant twitching of the muscles, are disturbed by dreams, frequently have night-terrors, and sometimes are troubled with somnambulism. A child in perfect health is also full of movement, but the actions are controlled. He runs about from dawn till dark, plays, capers, chatters, laughs, and is constantly giving natural expression to states of mind and body. A child who is ill or excessively fatigued does not frisk about, ceases play, mopes or curls up in a corner and talks little, laughs less, or is quiet until normal conditions are restored. A normal, healthy child is not quiet a single moment of his waking life. Some people call children lazy, but it is a false indictment. I doubt if a normal child has a lazy fibre in his being. Sometimes children do not respond in directions which we mark out for them, but this may be because of excess of activity in more enticing directions.

Inhibition.—Inhibition is really a form of activity although it does not issue in movement but in the stoppage of movement. The child who learns to sit still in school at proper times, to check the impulses to laugh, to whistle, to talk, and to shout is exhibiting action—controlled action. Similarly the one who refrains from saying malicious things about neighbors who may deserve it, who spreads the mantle of charity over real faults of others, who keeps his hand from his neighbor's pocket, who is faithful to a trust confided to him, is manifesting activity no less genuine and real than if he had acted upon all possible impulses of the moment. The child in training has to learn to master a multitude of impulses to forbidden actions. Naturally he would like to whisper, run and look out of the window, or play with his marbles, but a set of developed, warring impulses restrains him. The child is continually beset with stimuli which allure him from the tasks which we set him. Until he has developed a great many habits of acting and doing the chances are that the momentary stimuli will succeed in bringing about corresponding reactions, and the things we desire him to do are forgotten. Hence

the necessity of constant supervision of the child if we wish him to succeed in resisting undesirable stimuli and establishing appropriate reactions to the stimuli which we select for his training. If we can only make the desired stimuli as interesting as the undesirable, alluring ones we may secure spontaneous responses.

The Purpose of Motor Activity in Education.—The child's nervous system is ready to respond to a great variety of stimuli with equal readiness. One of the most important tasks of the teacher is to select desirable stimuli and keep them beating upon the child until settled pathways of discharge have been established, and at the same time to shield him from undesirable environment. With age, developed habits of action, and fixity instead of plasticity there is much less possibility of being influenced by new forces. Here is an opportunity of education. A child can learn a new movement, say skating, much more readily than the adult because the child's nervous system is so sensitive to many stimuli, while the adult has become impervious to all that do not fit in with his modes of action. Education deals largely with the problem of producing modifications of the mind. As the mind and its modifications can only be known through external expression, it becomes highly important to consider how ideas are correlated with expression and how stimuli may be utilized to produce efficient reactions and how in turn reactions may influence intellectual processes. Unfortunately the formalists have overlooked the necessities and importance of expression in education and have devoted all their attention to the absorptive process.

It is an auspicious sign that present-day educators are seeking earnestly for ways and means of incorporating into the formal curriculum more and more work which involves motor activity. We are beginning to realize that efficient education is not a process of cramming words into the child's memory. Ideas are incomplete until they are *real-ized.* The most distinctive feature of many ideas is this motor process. Most ideas are of little consequence until they find application in some form of outward expression or influence some activity, at least indirectly.

"We learn by doing" is a trite statement, but only half understood by many, and heeded in practice by still fewer. However, the slogan, "From impression to expression," is becoming an important watch-word of modern teaching. It needs to be supplemented by the statement, "Through expression to clear impression." But it is only just beginning to be realized that the subject of motor education demands special consideration. Even many of the advocates of motor training have in mind only the skill resulting from handiwork. The stock arguments made in favor of manual activities are somewhat as follows: "Manual training, handicrafts, and domestic science furnish activities which reveal inaccuracies of execution; they give opportunity to make finished products; they furnish physical exercise; they develop an appreciation of the dignity of labor; they enable the child to follow his interests, etc." These are all valid, but they do not touch the most fundamental reasons.

In a previous section the meaning of ideo-motor action was discussed. That every mental process has a motor accompaniment is a singular and significant fact. Experiments go to show that with every slightest thought delicate recording apparatus attached to the body may reveal changes in thought through the changes in the tracings made by the apparatus. Even our æsthetic, emotional states in contemplating a work of art probably excite muscular adjustments which would be revealed if properly adjusted instruments could be applied to the body. Muscular adjustments are so closely interwoven with all mental activities that we are justified in saying that they are a part of the entire process which could not come to full fruition without them. Our ideas of space have been gained by muscular measurements and when we think of space we cannot dissociate the muscular correlates from the totality of the idea-process. What would be our idea of skating without the various muscular accompaniments? A lecture on skating, even illustrated with pictorial representations, or, still better, with demonstrations of the process would never give one a real idea of skating. Similarly lectures on penmanship and drawing unaccompanied by

muscular co-ordinations on the part of the child himself would never teach him how to write. The only way to learn to write, is to write; to learn how to saw boards, is to saw boards, etc.

Mosso strikingly emphasized the idea of the intimate relation between motor and mental phenomena and the biological importance of motor training for mental development in his address, "Psychic Processes and Muscular Exercises." [1] He said: "Since neither chemically nor by the use of the strongest microscopes can we demonstrate differences in the nerve-cells of the cerebral cortex, it is therefore probable that none such exist. Hence, I believe that the psychic functions cannot be separated from the motor, that rather the psychic phenomenon and that which imparts the movement impulse both have their seat in the same cell. . . . If the so-called motor region of the brain is destroyed, it is found that a change of sensibility also takes place. These facts suffice to show that, up to the present, no absolute local separation of movement and sensibility is demonstrable." In another connection he states that there is in reality no distinction between motor and sensory cells.

Because of this very intimate relation between mind and muscles, Professor Mosso regards a knowledge of this subject of supreme importance for pedagogy. Motor nerve fibres are complete earlier than sensory. Muscular exercise he considers as better suited than sensory stimuli to develop the myelin sheaths (indicating maturity) of the nerves. Through a series of ingeniously contrived experiments, he demonstrated with absolute certainty the intimate and delicately adjusted relationship between the organs controlled by the sympathetic system and psychic states. Sir Crichton Browne wrote that "swaddling-bands so applied at birth as to restrain all muscular movements, and kept on during infancy and childhood would result in idiocy —a speculation to which the wretched muscular development of most idiots and imbeciles, and the fact that their mental training is most successfully begun and carried on through muscular lessons, gives some countenance."

[1] *Clark University Decennial Volume*, 1899.

Motor Development and Racial Intelligence.—Mosso believes that long continued motor activity among a people is promotive of intellectual development. In support of this view he says that "during the first epoch of the Renaissance, the greatest artists of Florence were all apprentices in the workshops of the goldsmiths. Luca della Robbia, Lorenzo Ghiberti, Filippo Brunelleschi, Francia, Domenico Ghirlandaio, Sandro Botticelli, Andrea del Sarto—to mention only a few examples—performed, during their apprenticeship, the simplest labors in the workshop of a goldsmith. But the exercise with which they gained their manual dexterity surely influenced also the development of their genius. In the beginning of the sixteenth century this school ended, but from the pedagogical stand-point it is still worth studying. If I may be permitted to express an opinion, I would say that the manual dexterity favored by this labor contributed much to the development of the great masters of genius.

"A fact which cannot be doubted is the many-sidedness of genius which some Italians of the Renaissance possessed, and which has never again appeared with like copiousness. Giotto was painter, sculptor, and architect. Leonardo da Vinci was a celebrated musician, a great painter, an engineer, an architect, a man of letters and of science. Andrea del Verrocchio was a goldsmith, sculptor, engraver, architect, painter, and musician. These facts are to be read in many histories of art. An incomparable example, however, is Michelangelo. For twelve years he studied anatomy on the cadaver, and afterwards painted the Sixtine Chapel and executed the tombs of the Medici and the dome of St. Peter's. . . . I am convinced that muscular movements have formed the omnipotence of genius, just as vice versâ, intellectual exercises affect advantageously the development of the muscles. . . . If the Greeks excelled all other peoples in genius, it was because they paid more attention than did the others to bodily exercise; they brought gymnastics, the study of bodily positions and bodily exercise, to a height which has never been reached by other peoples since their day." [1]

[1] *Op. cit.*, pp. 387–388.

The motor zone is the largest specialized portion of the human brain. Its exercise results in toning up the entire brain as well as in developing this particular zone. If abundant motor activity is lacking during the growing period the entire brain and nervous system suffer. Activities like play and manual work are absolutely fundamental to complete and symmetrical development. It would be better for the child under ten to be out of school kicking out the toes of his shoes than sitting in a hot, stuffy school-room and precociously conning his printed, intellectual lessons. There is time enough for the intellectual formalism later on if a proper physical substructure has been built up.

President Hall says[1] that "muscles are in a most intimate and peculiar sense the organs of the will. They have built all the roads, cities, and machines in the world, written all the books, spoken all the words, and, in fact, done everything that man has accomplished with matter. If they are undeveloped or grow relaxed and flabby, the dreadful chasm between good intentions and their execution is liable to appear and widen. Character might be in a sense defined as a plexus of motor habits. To call conduct three-fourths of life, with Matthew Arnold; to describe man as one-third intellect and two-thirds will, with Schopenhauer; to urge that man is what he does or that he is the sum of his movements, with F. W. Robertson; that character is simply muscle habits, with Maudsley; that history is consciously willed movements . . .; or that we could form no conception of force or energy in the world but for our own muscular effort; to hold that most thought involves change of muscle tension as more or less integral to it—all this shows how we have modified the antique Ciceronian conception *vivere est cogitari*, to *vivere est velle*, and gives us a new sense of the importance of muscular development and regimen."

Motor Training More than Manual Training.—When motor education is mentioned manual training is first thought of, but there are many other activities that involve motor co-ordination,

[1] *Adolescence*, I, p. 131.

and all mental processes necessitate motor activities to make them clear. Let us note a few illustrations. Our ideas of a pound, or an ounce, would indeed be vague if we had never gained personal experimental evidence through lifting those weights. Our notions of space relations are all primarily built up from muscular experiences. The infant's notions of distance are vague until his muscular experiences render them precise and clear. In fact, it is doubtful if the child has any notions of distance antecedent to his experiences in measuring and testing. His reachings and travels and eye-movements all contribute to his knowledge of space. Retinal images alone could reveal little. Eye movements must supplement and even contribute most of the data. It is no fiction to say that children grasp for the moon. Why should they not do so? Before muscular experiences disclose the real meanings, a foot is not different visually from a rod, or a mile. I have even seen children seven months old reach for the moon. Both two-dimensional and three-dimensional space are realized only through explorations accomplished by muscular movements.

Some Fundamental Motor Concepts.—As the child learns the use of its arms, accomplishes the art of creeping, and the still more complex art of walking, his conceptions of space grow wonderfully. A child not allowed to creep or to walk is being deprived of a most fundamental birthright. Like all individuals who never travel he remains provincial. These principles should receive abundant application in every-day education and in school-room practice. When pupils are learning the tables of denominate numbers, instead of going through mere word mouthings they should be required to lift weights, and measure distances, areas, and volumes. An inch, a foot, a yard, a mile, an acre, a cubic foot, a cord, should come to stand for definitely imaged realities. A boy who has sawed wood will not forget what a cord is, nor will one who has walked miles, and around and over acres be dependent upon verbal memories for his knowledge of these units. If pupils are studying the table of wood measure they should actually measure piles of wood. My

own knowledge of a cord of wood was made exceedingly tangible and vivid. Days and weeks at the wood-pile and in the forest chopping cordwood supplemented by loading and hauling the wood to market over rough roads gave me such a personal knowledge of every element in the problem that the ideas will be mine as long as time shall permit my brain and muscles to function. Not every boy, and still less every girl, has need of making wood measure so clear, real, and vivid, but the method of real learning therein illustrated is applicable to every subject. All ideas studied should be gained, as far as possible, through actual experience. The more nearly the experience grows out of life's activities and interests, the better.

If an idea of "sixteen ounces makes one pound" is to be gained, the only real way is primarily by lifting or "hefting" and secondarily by seeing the relations. A knowledge of an inch, a rod, a mile, an acre, etc., can only be gained by actual personal measurement. I once visited a high-school class which was studying the United States system of land survey. They were talking glibly about acres, sections, and square miles. Suspecting that their knowledge consisted of mere words, I asked: "How long would it take you to walk around a section of land?" "Fifteen minutes," was the instant reply of one pupil. My belief was confirmed and I replied: "You must be a sprinter." The farmer boy's knowledge of acres is gained by following the plough up and down the furrows, day after day, fencing in an acre, ten acres, or fifty acres, mowing the hay, cradling the grain, binding the sheaves, even by grubbing out the trees and clearing the land. Of course, acres are not the only concepts worth while knowing. It is quite probable that we might go through life ignorant of the concepts and be highly respected and intelligent, but we should have other concepts which are exactly as definite as the farmer boy's of acres, rods, and sections. The example illustrates the end and the means to be employed in gaining any kind of real knowledge.

The task of education has been considered too largely as one of instructing the child so that he may know *about* things. But

a great part of a child's education should be concerned with teaching him to *do* things, to put into execution ideas understood, sometimes even to utilize ideas and processes which are vaguely or not at all understood. It is highly important that the child be able to stand well, to run easily, to sit properly, to breathe correctly, to sleep adequately and under hygienic conditions, to move gracefully, to close doors quietly, to avoid awkwardness, to be at ease in company. He cannot claim to be properly educated without having developed the habit of careful attention to health and personal appearance; unless he habitually observes good manners, habitually manifests politeness and all other signs of good breeding; nor without regularly using the mother tongue easily, accurately, pleasantly, and forcefully. Along with these should be thoroughly acquired the habits of right moral responses and a cheerful, happy, altruistic attitude toward life's activities in general. All these come only after much practice, and they are imperfect until they become largely automatic. They must have become, not second nature, but primary nature. Along with his play the child should have the "work habit" thoroughly ingrained, and much of this work should be manual. Manual training in the schools and football and gymnasium exercises should supplement the motor training afforded by useful occupations and not supplant it.

Motor Activities in the Home.—Every boy and every girl should have definite home duties demanding muscular exercise and skill. The boy can mow the lawn, split the wood and carry it in, tend the furnace, make boxes and shelves, mend the fences, run errands, wash dishes, sweep, dust, make beds, etc. His sister should be equally interested in gardening, dishwashing, and in addition should be able to cook a meal, cut and fit a garment, or saw a board and drive a nail without danger to her fingers or to bystanders. Every home should have its garden and its tool-chest. Both boys and girls should have an intelligent interest in them derived through active acquaintance. "Into the education of the great majority of children there enters as an important part their contribution to the daily labor

of the household and the farm, or, at least, of the household. It is one of the serious consequences of the rapid concentration of population into cities and large towns, and of the minute division of labor which characterizes modern industries, that this wholesome part of education is less easily secured than it used to be when the greater part of the population was engaged in agriculture. Organized education must, therefore, supply in urban communities a good part of the manual and moral training which the co-operation of children in the work of father and mother affords in agricultural communities. Hence the great importance in any urban population of facilities for training children to accurate hand-work, and for teaching them patience, forethought, and good judgment in productive labor."[1]

Hall maintains that "adolescent girls, especially in the middle classes, in upper grammar and high school grades, during the golden age for nascent muscular development, suffer perhaps most of all in this respect. Grave as are the evils of child labor, I believe far more pubescents in this country now suffer from too little than from too much physical exercise, while most who suffer from work do so because it is too uniform, one-sided, accessory, or under unwholesome conditions, and not because it is excessive in amount. Modern industry has thus largely ceased to be a means of physical development and needs to be offset by compensating modes of activity. Many labor-saving devices increase neural strain, so that one of the problems of our time is how to preserve and restore nerve energy. Under present industrial systems this must grow worse and not better in the future. Healthy natural industries will be less and less open to the young. This is the new situation that now confronts those concerned for motor education, if they would only make good what is lost."[2]

The Laboratory.—Not only do our modern laboratory methods furnish sensory experiences but also opportunities for motor accompaniments. Whole classes of ideas would be vague and

[1] Charles W. Eliot, *Educational Reform*, p. 405.
[2] *Adolescence*, I, p. 168.

incomplete without the knowledge furnished through the motor activities. The laboratory is not only a place for observing things but also a place for doing and making, a place for *labor*—a "*labor-atory*." The engineering student is obliged to make models, and to construct apparatus and machines. He is continually engaged in making, mapping, and charting, and where actual constructive representation is not possible or feasible, plans are drawn to scale, and in manifold ways either primarily or secondarily the muscles are employed in gaining, vivifying, and fixing ideas of realities. The modern medical student employs eye, ear, touch, and every sort of motor experience possible. Not only must he see and touch, but he must train himself to delicacy of measurement in locating various portions of the anatomy. Touch is not of the highest use when passive. Active touch refines exceedingly our passive tactile perceptions. Even the delicacy of visual perceptions are largely due to eye-movements. Students in all laboratory courses should be continually engaged in making, mapping, charting, and constructing.

Manual Training.—Some form of manual training should find a place in every school curriculum, and all pupils in the school should be required to do some of the work. This is not to take the place of physical training, nor can we substitute for it the manual work ordinarily done at home. The school should emphasize the principles of manual training rather than attempt to develop extreme skill in any one direction. Although, on practical grounds, I should advocate trade schools, theoretically, I should argue against them. The purpose of all education should be to secure not knowledge alone, but also some form of expression of the knowledge gained in life's activities. All education should have this practical aim. There is no form of education which should not be practical in that it should result in action which furthers some end of life. Because of the correlation of the mind and body, there is a tendency for all ideas to issue in some form of motor expression. However, unless there is definite training the resulting action is not necessarily a desirable one. The energies developed through an idea may be dis-

sipated or diffused rather than concentrated and hence produce useless results. This is the outcome of much of our knowledge. Its active results are indefinite and of no importance to the individual. Hence the necessity for definite training in correlating ideas and actions.

Manual training affords one of the best means for correlating ideas and actions and making actions definite rather than diffused. It is sometimes urged that those engaged in manual labor do not need manual training. This, however, is erroneous. They perhaps do not need so much manual training as those who are engaged in sedentary occupations, but even the farmer and the artisan need training which will secure precision of movement. Most laborers do not use sufficiently the finer muscles of the body and hence never secure great precision of movement—and consequently lack precision of thinking.

The majority of our ideas, however abstract, are fundamentally dependent upon some form of motor activity for their exactness. The philosopher, the author, and the scientist, equally as well as the laborer or the tradesman, need manual dexterity and accuracy of motor co-ordinations because their ideas cannot be clear or exact except as they are gained and clarified through motor activity. A large part of the success of the chemist depends upon his dexterity in manipulating apparatus and devising experiments. Without manual skill he could not accurately test old theories nor develop new ones. The slightest inaccuracy in weighing a substance oftentimes vitiates whole trains of scientific results. Hence the chemist, the physicist, and the engineer must have definite manual skill. The great surgeons owe their success in no small degree to the extreme fineness of their sense of active touch. Without this fineness even though possessed of all the medical theories known to the scientific world, no physician could become a great surgeon.

Again, for example, all our notions of weight, size, distance. hardness, roughness, etc., are dependent upon motor activity, If not gained in fundamental ways the resulting ideas are entirely lacking in definiteness and clearness and usually consist merely

of words and symbols. We are apt to become mere accumulators of words, vendors of second-hand knowledge about things, rather than possessors of first-hand concepts. We are apt to become traffickers in symbols of knowledge, rather than possessors of knowledge itself. We are apt to become dreamers instead of doers. Further, since the race primarily gained its knowledge at first hand, and only recently began to use written symbols extensively, we are admonished that the proper method of gaining knowledge is through the senses aided by motor activity. Scripture[1] emphasizes the importance of manual training in the following incisive fashion: "Manual training develops the intellectual side of the mind as nothing else can. By book-work or by study a boy never learns to think or understand, or even remember, as well as he might; it is only when he gets involved in sports and games like base-ball and canoeing, or in machinery like lathes and buzz-saws, or in laboratory complications like chemical analyses and measurements of electricity, that he ever learns to think fully as a man."

Various Means of Motor Training.—In considering motor education it must not be overlooked that there are manifold forms of motor activity besides those connected with the *manual* arts. All activities which give control of the body and secure poise are important to cultivate. Even without possessing manual training departments as such the school possesses many opportunities for important motor training. Walking, standing, sitting, silence, orderliness, good manners, politeness, all demand the development of motor habits. The plays and games can be turned to good account. Writing, drawing, map-making, constructing apparatus and setting it up, conducting experiments, all demand a high type of manual training. A musical education depends largely upon skill resulting from motor education. Apart from the rôle performed by the sensitized ear, musical skill is entirely a matter of training muscles to respond in delicate co-ordinations. Singing and playing any musical instrument require motor training of a high degree.

[1] *Manual Training Magazine*, I, 24.

Motor Aspect of Language.—Every idea-process gets interwoven with a great variety of muscular co-ordinations, and among the most prominent are those involved in our use of language. The words and symbols are not only means of mental economy, expression, and of understanding others, but they become in reality a part of the ideational process. The idea could never have attained the same clearness without the use of words; in fact full-fledged abstractions could not have been gained at all without the use of language and they cannot be revived without employing language symbols. Consequently, in considering motor training we must not overlook these most refined of all motor relations between thought and language. There must be adequate opportunity for expressing ideas not only for the purpose of rendering the ideas permanent, but equally important and more fundamental, for the purpose of making the ideas themselves clear and vivid. Real ideas are not something *added* to one's mind, but a *part of* the mind itself. Halleck says to speak of "motor ideas" is as tautological as to speak of "wet water." One of the specific purposes of the recitation is to afford opportunity for expression. The recitation may demand oral expression, dramatization, written exercises, drawing, constructing apparatus, moulding, or some form of manual training. The motor activity serves not only to fix ideas, but also to clarify and enlarge them, and even to furnish new ideas. To abolish the recitation and depend entirely upon the absorptive process is to fail to utilize one of the most important means of education.

Vocal speech, for example, requires the nicest sort of motor adjustments, and the ability to talk fluently, accurately, and in a pleasing manner is no mean accomplishment. The possession of this ability implies accuracy and clearness of ideas as well as training in expression. Oral speech is often one's most valuable asset. It is usually the best index of what we know and what we are. No motor training is harder to acquire, rarer to be observed, and worthier of cultivation than perfect oral speech. Much time in the child's early life is occupied with acquiring

speech. The process is largely one of subconscious imitation, but the results are no less certain and valuable than when gained through painful, conscious attention to the process. The child who hears correct language in the home is fortunate indeed. He is saved many painful hours of unlearning. The schools also are relieved of the burden of undoing undesirable habits. Language training in the lower school grades should be largely oral and is a fundamental problem in motor adjustment. When teaching written expression, of course, the problem is also one of motor training, and even a most important kind of manual training. Learning a foreign language demands the acquisition of many motor adjustments. The memorizing of a vocabulary is for certain types of individuals very largely a task of motor memory. Acquiring accuracy and facility in speaking the foreign language is pre-eminently a motor task. To write it demands still other muscular training.

Training of Defectives.—The methods of dealing with defectives have been very radically modified during the last few years, and one of the directions of change is in the greater employment of motor activities. Formerly the first attempt to train the feeble-minded consisted in an effort to teach them reading and writing—the very last things that they needed. Now, with greater wisdom, motor training is made the first consideration. The unfortunates are taught to walk, run, stand, throw and catch a ball, climb ladders, use simple tools, put on their own clothing, to wrestle, etc. These activities give control of the larger movements of the body and gradually finer co-ordinations are introduced. If they master these activities they are given exercises in gaining sense-perceptions through a variety of motor activities. Manual training occupies an important place. Abstract intellectual work like reading and arithmetic are taken up only if sufficient progress has been made in the foregoing to warrant the belief that intelligent progress can be made. Methods of dealing with the criminal classes have also been transformed in many reformatories. Manual training occupies the foreground there.[1]

[1] See the *Elmira Reformatory Year Book* for 1897, pp. 57–121.

General Suggestions.—James says concerning the necessity for reactions:[1] "If all this be true, then immediately one general aphorism emerges which ought by logical right to dominate the entire conduct of the teacher in the class-room. *No reception without reaction, no impression without correlative expression*—this is the great maxim which the teacher ought never to forget. An impression which simply flows in at the pupil's eyes or ears, and in no way modifies his active life, is an impression gone to waste. It is physiologically incomplete. It leaves no fruits behind it in the way of capacity acquired. Even as a mere impression, it fails to produce its proper effect upon the memory; for, to remain fully among the acquisitions of this latter faculty, it must be wrought into the whole cycle of our operations. Its *motor consequences* are what clinch it. Some effect due to it in the way of an activity must return to the mind in the form of the *sensation of having acted*, and connect itself with the impression. The most durable impressions are those on account of which we speak or act, or else are inwardly convulsed. The older pedagogic method of learning things by rote, and reciting them parrot-like in the school-room, rested on the truth that a thing merely read or heard, and never verbally reproduced, contracts the weakest possible adhesion in the mind. Verbal recitation or reproduction is thus a highly important kind of reactive behavior on our impressions."

If it is a law of life that expression naturally follows impressions, we may rightly be challenged with the query why education needs to concern itself with producing reactions? The answer is: although ideo-motor action is the rule, we must keep in mind the fact that in experiencing any new impressions, children, and even adults, are much like primitive organisms. Energy tends to be diffused and reactions are so scattered that the effects are lost or else the reaction may be wholly at variance with the idea. A given stimulus may become coupled with an undesirable response as, for example, the child may be asked to spell a word and happen upon a misspelling and this misspell-

[1] *Talks to Teachers*, pp. 33, 34.

ing tends to stick unless education furnishes the right response. An incorrect pronunciation, a bad method of holding the pen, or an improper posture may be fixed upon by chance, and training must be given to guard against them or eradicate them if once established.

Again, the response may be so diffused and general as to be very indefinite and inexact, as when the child is beginning to talk. He hears words and is stimulated to speak, but only a long process of trial and error establishes correctness of response. The habit once fixed is a means of mental enslavure. We are by no means certain either that stimuli have been perceived accurately until they produce the right response. When the child fails to pronounce a word correctly we have reason to be suspicious of his perception of the proper sounds. Of course it is possible to perceive relations that cannot be expressed, but in general the more accurate and refined the expression the more exact the perception. Education must then secure reactions for the purpose of understanding, clarifying, and refining perceptions, concepts, and other mental processes.

XXII

THE NATURE OF THINKING

Preliminary Meaning of Thinking.—In the older books on psychology which divided the mind very definitely into separate and distinct "faculties," thinking was considered as wholly different from other intellectual processes. But when we analyze the process and find that it consists of carefully considering, weighing, comparing, and forming judgments concerning given data, we notice that this is not wholly different from what takes place in perception. In fact, in any effective process of recognition or of identification, similar processes take place. The child that recognizes its mother or a toy as familiar must go through the mental act of comparing the object present to the senses with the mental idea of it and then judge that it agrees with that idea. If not recognized it would be because the sensations did not correspond to any mental product in stock. Whatever we perceive definitely must be marked off from all other objects. For example, in perceiving my lamp on the table before me I must differentiate that from the table and from the books strewn around. I must also compare it with my idea of my lamp and conclude that it corresponds with my remembered idea. Then only do I know this object to be my lamp.

Thinking in Other Processes.—In remembering or imagining effectively we must likewise note resemblances and differences, make analyses, compare, weigh, and judge whether the remembered or imagined thing is the one desired. In reciting a lesson the child mind, by virtue of mechanical associations so characteristic of childhood, recalls many things that are irrelevant. To recite properly he must scrutinize these ideas and exclude those that do not bear upon the point under discussion. This is to

think. That the child does not give an orderly array of facts is not an indication that he does not think, but it is evidence that he does not think carefully. Some types of school work do not demand a high order of thinking. They are based largely upon the formation of mechanical associations. But even such work demands some thinking. For example, in reciting an elementary lesson in a foreign language, which is largely memory work, there must be some comparison and discrimination. But, to acquire the vocabulary of a foreign language does not require a high order of thought, because the number of ideas to be compared is small, and mechanical registration has made the matter largely habitual. To master the grammar and to learn to read critically or to evaluate the literature critically require most careful, painstaking, and exacting comparisons—thinking. To build up a consistent imaginative product requires a careful discrimination among the many pictures that may be suggested. The successful poet, painter, or sculptor must exercise careful judgment concerning the possible combinations suggested in imagery. Even the one who indulges in day-dreams or allows the fancy to run riot must exercise some selective judgment. Only that which is pleasing is harbored; that which is painful or displeasing is rejected. To do either involves discrimination, identification, and judgment.

Halleck says:[1] "It was formerly supposed that human beings did not think early in life; that then they perceived and remembered; that after they had seen and treasured up a great deal, they began to think. These processes were considered to be as sharply marked off from each other as the Dead Sea and the ocean. We now know that no one can perceive without thinking at the same time." Dr. Harris has brought this idea before us very cogently, and some may think even in an extreme way in the following statement:[2] "Sense-perception is not a simple act that can be no further analyzed. In its most elementary forms one may readily find the entire structure of reason. The differ-

[1] *Psychology and Psychic Culture*, p. 182.
[2] *Psychologic Foundations of Education*, p. 63.

ence between the higher and lower forms of intelligence consists not in the presence or absence of phases of thought, but in the degree of completeness of the consciousness of them —the whole is present, but is not consciously perceived to be present, in the lower forms. The whole structure of reason functions not only in every act of mind, no matter how low in the scale—say even in the animal intelligence—nay, more, in the life of the plant which has not yet reached the plane of intellect —yes, even in the movement of inorganic matter: in the laws of celestial gravitation there is manifested the structural framework of reason."

Ribot, in *The Evolution of General Ideas*, similarly remarks that the operations of abstraction and generalization "exist already in perception, and advance by successive and easily determined stages to the more elevated forms of pure symbolism, accessible only to the minority." [1] Romanes emphasizes this genetic view of mind and its varying degrees of complexity as opposed to the "compartment" psychology. He believes that even reason is involved in perception. To be sure in simple perceptions reasoning is nothing more than crude inference, but inference consists in the perception of relations, and the formation of conclusions is the basis of reasoning. The following quotation is apropos with reference to the relations among the various intellectual powers, as illustrating the meaning of thinking, and also because of its importance in showing the evolutionary stages of the processes. "While treating of the genesis of perception I pointed out that the faculty admits of numberless degrees of elaboration. These we found to depend largely, or even chiefly, upon the degree of complexity presented by the objects or relations perceived. Now when a perception reaches a certain degree of elaboration, so that it is able to take cognizance of the relation between relations, it begins to pass into reason, or ratiocination. Contrariwise, in its highest stages of development, ratiocination is merely a highly complex process of perception—*i. e.*, a perception of the equivalency of perceived

[1] Preface, p. v.

ratios, which are themselves more or less elaborated percepts formed out of simpler percepts, or percepts lying nearer to the immediate data of sensation. Thus, universally ratiocination (reasoning) may be considered as the higher development of perception; for at no point can we draw the line and say that the two are distinct. In other words, a perception is always in its essential nature what logicians term a *conclusion*, whether it has reference to the simplest memory of a past sensation or to the highest product of abstract thought. . . . There is no real break between cognition of the lowest and of the highest order." [1]

Binet in his book, *The Psychology of Reasoning*, has a chapter on "Reasoning in Perception," in which he traces the development of perception and shows that "the work involved in every perception is identical with the operation which consists in drawing a conclusion when the premises are given." [2] "From the logical point of view the percept is a *judgment*, an act which determines a relation between two facts, or in other words, an act which affirms [or denies] something of something." [3] "In short, perception and reasoning have the three following characteristics in common: First, they belong to mediate and indirect knowledge; second, they require the intervention of truths formerly known (recollections, facts of experience, premises); third, they imply the recognition of a similitude between the fact affirmed and the anterior truth upon which it depends. The union of these characteristics shows that perception is comparable to the conclusions of logical reasoning." [4] It should perhaps be stated that Binet adds in a foot-note the explanation that, "in perception, the mind never rises so high as a general conclusion; it simply comes to a conclusion on the object present to the senses. It is an inference from particular to particular, and likewise, in the case where perception is aided by a considerable number of anterior experiences, it is a deduction."

Unity of Mental Life.—From the emphasis afforded by the opinions of the foregoing notable psychologists we may justly

[1] *Mental Evolution in Animals*, p. 319.
[2] P. 91. [3] P. 78. [4] P. 88.

reaffirm that thinking is not an absolutely new process, but that it is present in varying degrees in all mental processes above mere sensations—which are like the chemist's atom—hypothetical. Any process that rises to the dignity of a perception involves thinking. The sharp lines of demarcation between the various phases of mental life, which to the untrained or the beginner in the study of psychology seem to exist, no longer are visible. On the contrary, the several "faculties" or powers which seemed to be so definitely separated from each other now appear to shade off into each other. Mental life instead of being a piece-work is seen more and more as a unity. Definitions of mental powers which at first seemed absolutely inclusive and exclusive now need many qualifying codicils. It is necessary in all science to classify knowledge. That is one meaning of scientific procedure. We classify and arrange material into groups for the purpose of isolating it and subjecting it to closer scrutiny. The classes then serve the same functions as words. They are tickets or signs by which groups of ideas are identified. In their highest phases of development two kinds of mental life are, of course, clearly marked off from each other. In their more elemental phases they may be most vitally related and difficult to distinguish from each other. For example, the emotions and the will seem clearly separated, yet a close analysis of their origins reveals indistinguishable likenesses and real relations. Again some forms of memory seem absolutely different from some forms of imagination, but we have seen how difficult it is to distinguish them in their origins. In fact is this not true in the material world? Man is clearly different from a tree, but how about the simplest plants and the simplest animals? Who can tell absolutely the difference between vegetable and mineral substances?

As in the material world it becomes convenient to separate objects into groups for analysis, so in the mental world we find it convenient to arrange the diverse activities into groups of "faculties," or powers, or processes, or whatever we may conventionally designate them. But we must bear in mind that

no phase of mental life exists alone. If this idea of diversity in unity is thoroughly comprehended, we are then prepared to understand that this chapter is not our first consideration of the process of thinking. This is merely the first time we are to select and isolate for special consideration certain characteristics which serve to differentiate higher thinking from other processes.

Higher Phases of Thinking.—While it has been maintained that thinking is a very elemental process, yet it should be distinctly understood that the examples mentioned represent only very crude forms of thinking. The advanced stages of thought involve abstraction of a high degree, besides the formation of logical concepts, deliberate judgment, and reasoning. This last process means the careful weighing and sifting of concepts and the formation of newer and higher concepts. Both analysis and synthesis are employed to a higher degree. The attention must be fixed upon each of the possible relations and then upon the relation expressing the conclusion.

Dewey has constructed the following definition, but we must keep in mind that it is the higher forms of thinking to which it applies. He says: "Thinking may be defined *as knowledge of universal elements; that is, of ideas as such, or of relations.* In thinking, the mind is not confined, as in perception or memory, to the particular object or event, whether present or past. It has to do, not with this man whom I see, or the one I saw yesterday, but with the idea of man; an idea which cannot be referred to any definite place or time; which is, therefore, general or universal in its nature. Its closest connection is with imagination, which deals with the general element in the form of a particular concrete image, but in imagination the emphasis is upon this particular form, while in thinking the particular form is neglected in behalf of the universal content. We do not imagine man in general; we imagine some characteristic man, Othello, King Arthur, etc. We cannot think a particular man; we think man in general; that is, those universal qualities common to all men—the *class* qualities." [1]

[1] *Psychology*, p. 202.

Sully writes:[1] "The intellectual operations hitherto considered have had to do with the concrete, that is to say, the presentations of the senses, and the representations formed on the models of these. To perceive, to remember, and to imagine have reference to some particular object, as the river Thames, or a particular occurrence, as the coronation of the German emperor in 1871, in its concrete fulness as it presents itself or would present itself to our senses. But we may reflect on some one attribute of these, as the movement, or the width of the river, or the splendor of this particular ceremony; and we may reason about rivers or ceremonies in general. When we do thus separate out for special consideration particular attributes or aspects of concrete things, and consider things in their relation to other things, and to deal with them as generalities, we are said to *think*."

Huxley, that wonderful past master in the highest forms of critical thinking, said: "Do you know what it is to think? It is to still the voices of revery and sentiment, and the inclinations of nature, and to listen to the language of reason; it is to analyze and discriminate; it is to ask the why and the wherefore of things, to estimate them at their real worth, and to give them their proper names; it is to distinguish between what is of opinion and what is of speculation—what of reason and inference, and what of fancy and imagination; it is to give the true and the false their respective value; it is to lay down a clearly defined line between what is of true science and what is of surmise and conjecture; it is to know where one's knowledge ends and where one's ignorance begins; above all, it is to arrive at that condition of mind in which one can determine how and when to express what he knows, and in which one performs the more difficult task of abstaining from speaking about that of which he knows nothing."

Importance of Effective Thinking.—The school should train the pupil to think, and to think effectively. That is, it should free the child from superstition, it should train him to weigh

[1] *Outlines of Psychology*, p. 259.

authorities, not to accept things dogmatically. It should train him to form conclusions from given data. These conclusions should be just such, and only such, as are warranted by the facts in hand. Some people form no conclusions at all for themselves. They never dare assert opinions unless others bear them company. They are largely echoes of other people. Still others form opinions, but too hastily, the conclusions not being based on evidence and unwarranted by the facts. Both these tendencies must be overcome. There is the child who repeats only what the book says, and again the child who is continually talking without thinking. Both of these classes may be helped by careful attention in requiring them to be judicial. One needs to be pushed into the water to be shown that he can swim, and the other needs to be restrained from jumping into the whirlpools.

Independence in Thinking.—Independence in thinking is a rare but thoroughly economical mode of activity. Many people are so unused to thinking for themselves that they would be frightened at the appearance in consciousness of a thought really their own. It has been said that "animals think not at all and some men a little." Most of the effective thinking of the world is carried on by a relatively small number of individuals. The rest of the world are mere echoists. This is a terribly wasteful process, and sinful. There are hundreds of every-day illustrations which prove that many people do very little independent thinking. The majority of voters cast their ballot for the same party as their fathers belonged to, or allow themselves to be dictated to by a few political bosses. Multitudes of people regulate their conduct, their business, and their speech entirely by other people's thoughts. Their conclusions are all second-hand and give evidence of great mustiness. If one doubts the force of tradition just let him try to secure some reform in any direction he pleases. A new measure is at once regarded with suspicion simply because no one ever knew of that before. Every new idea proposed for the schools is at once branded by the masses as a "fad."

Millions of gallons of patent medicines containing alcohol and

opiates as the chief ingredients are sold annually. Thousands of babies are stupefied by being dosed with "soothing syrups" containing opiates. It is no wonder that so many children grow up stupid. The "quiet" produced by the opiates sometimes persists through life. Hygienic rules which common-sense should teach every one are ever being ignorantly disobeyed. The history of medicine is replete with illustrations of the influence of charms, incantations, and fetichisms. Even to-day the masses can be wheedled into absurd notions concerning medicinal values. Let some one announce a "vegetable remedy," or still better an "Indian vegetable remedy," or a "vegetable remedy discovered by a missionary or an Egyptian," and it at once has millions of throats open to receive it.

When Columbus asserted that the earth was spherical people scouted the idea, and when he passed through the streets jeered at him as being an insane man. Had they not evidence through their own senses that disproved such a crazy theory as he proposed? A little later Galileo, Copernicus, and Bruno shocked the world by asserting that not the earth but the sun is the centre of the universe. They were not only scorned but Bruno was burned at the stake because he would not retract, and Galileo, after bitter persecution, was made to swear that he had never believed such blasphemous doctrines. Could the people not see with their own eyes? The sun rose every morning and set every night after travelling round the earth. Various conjectures were rife as to what it did during the darkened half of the day, but of its course during the other hours and of its relation to the earth they were positive. Could they not believe their own senses? And Aristotle had never mentioned such a preposterous proposition. Munroe[1] writes that "during this long period . . . the dry formalism and dead conning of words . . . led, inevitably, to the dreary hootings of scholasticism. This owlish learning, growing more outrageous as its metaphysics became more absurdly deep, soon lost all point of contact with humanity. Its husks of syllogism drove all appetite for

[1] *The Educational Ideal*, p. 9.

real learning from the mind of the student, and he contented himself, ignorant of better intellectual food, with a smattering of Latin, a jargon of philosophy."

Superstitions and signs have by no means all belonged to a by-gone age. Why does the horseshoe hang over so many doors? Why do so many people hesitate to begin a journey or a new piece of work on Friday? Why do fewer steamships start on Friday than any other day, if they can get plenty of passengers for Friday? Recently I met a man carrying a rattlesnake's tail in his hat-band. On inquiry I found that he did this to ward off rheumatism! He firmly believed in the efficiency of the senseless process. Why do farmers plant their potatoes in the new of the moon and some other crops in the old of the moon? Why do they consult the almanac before slaughtering a beef or weaning a lamb? To-day happens to be "ground-hog day" and thousands of people are pinning their faith in the remaining winter weather upon the supposed action of the innocent little creature. I recently heard a man say, "The winter has been so cold, we shall have an early spring." A little applied knowledge of the convertibility of heat into other forms of energy would teach that there is no necessary truth in his statement.

The School Should Train to Think.—The school can perform no higher function than to teach independence in thinking. Unfortunately, as many schools are conducted, everything tends to beget dependence. The child finds himself in a realm of mysterious, meaningless symbols, strange customs, and arbitrary rules and regulations for his conduct, and is forthwith made to feel that all must be learned and accepted unquestioningly. As he progresses he finds words without significance which he must pronounce, read, and spell. Rules in arithmetic and grammar are forced upon him to be mechanically memorized without illumination; long strings of dates, names of kings, queens, dynasties, battles, and generals must be recited and called history; names of capes, bays, rivers, and mountains, which have only location must be committed, etc. Most of this is without a glimmering of meaning or a particle of interest in the

content on the part of the learner. The child early learns by imitation to accept the husks of knowledge and to produce the *certificates* for real knowledge when called on to recite. Instead of continuing in a questioning attitude he learns that the line of least resistance is to take everything ready-made. Dewey remarks that "what is primarily required is first-hand experience. Until recently the school has literally been dressed out with hand-me-down garments, with intellectual suits which other people have worn."

Although it is the utmost pedantry to expect the child to be a discoverer or an inventor of knowledge, new and valuable to the world, yet he must be led through the established truths in the "course" in such a way that it shall possess interest, rationality, and meaning for him. Many truths he can and should be led purposively to discover by himself and for himself—not for the world—and what you point out to him should be understood and full of interest. Of course in so doing he will not make independent discoveries. But you will have supplied the conditions which it may have taken the world ages to discover, and the child will now perceive the relations and the results. With all the rule-of-thumb exercises, the parrot memorizing, and the dogmatic statements which the child finds at school, it is little wonder that he forgets that he has ideas of his own when school questions are under consideration, even though he is ultra-independent on the diamond or the gridiron and among his fellows. Coleridge says: "To educate is to train to think, for by active thinking alone is knowledge attained. Without active thought we cannot get beyond mere belief, for to pass from belief to knowledge means to sift and weigh evidence for oneself. . . . Alas," he exclaims further, "how many examples are now present to my memory, of young men the most anxiously and expensively be-school-mastered, be-tutored, be-lectured, anything but educated; who have received arms and ammunition, instead of skill, strength, and courage; varnished rather than polished; perilously over-civilized, and most pitiably uncultivated! And all from inattention to the method dictated

by nature herself, to the simple truth, that as the forms in all organized existence, so must all true and living knowledge proceed from within; that it may be trained, supported, fed, excited, but can never be infused or impressed."[1]

Inexact Use of Language.—It is difficult for the average person to do much abstract and sustained thinking. There is apparently an inertia of mind to be overcome in order to do real thinking. The mind becomes habituated to acting in certain fixed channels. This is rendered more probable on account of stereotyped language forms. We sometimes think we are expressing ideas when we are using only the symbols. If we examine our oral speech we are surprised at the great number of common stereotyped expressions. We deal largely in currency of the denominations stamped by popular usage and rarely pay in original, independently coined denominations. Let any one attempt a description and see how largely he uses habitual expressions. In a great measure our language comes to us ready-made and most people use many words and expressions with very indefinite notions of the meanings. Creighton says: "The only way in which we can be saved from becoming 'intellectual dead-beats,' is by the formation of good mental habits. It requires eternal vigilance and unceasing strenuousness to prevent our degeneration into mere associative machines."[2] Bacon writes: "Men imagine that their reason governs words, whilst, in fact, words react upon the understanding."[3] That noble and painstaking pioneer in critical thinking, John Locke, writes on the confusion of words with ideas: "Men having been accustomed from their cradles to learn words which are easily got and retained, before they knew or formed the complex ideas to which they were annexed, or which were to be found in the things they were thought to stand for, they usually continue to do so all their lives; and without taking the pains necessary to settle in their minds determined ideas, they use their words

[1] Quoted by Welton, *The Logical Bases of Education*, p. 252.
[2] *An Introductory Logic*, p. 245.
[3] *Novum Organum*, Aph. LIX.

for such unsteady and confused notions as they have, contenting themselves with the same words other people use, as if their very sound necessarily carried with it constantly the same meaning. . . . This inconsistency in men's words when they come to reason concerning their tenets or their interest, manifestly fills their discourse with abundance of unintelligible noise and jargon, especially in moral matters. . . . Men take the words they find in use among their neighbors; and, that they may not seem ignorant what they stand for, use them confidently, without much troubling their heads about a certain fixed meaning."[1] Creighton shows us that phrases like "class legislation," "sound money," "the people's cause," "liberty," "justice," "equality," etc., are frequently used in a very indefinite way. "A man may easily deceive himself, and, as he repeats familiar words and phrases, imagine himself to be overflowing with patriotism, or with sympathy for others, or with religious feelings."[2]

Habits and Effective Thinking.—It is important for the student to understand early the force and value of habit. Much time is lost by every one of us because our early training did not render automatic all those activities that we have to perform constantly and in the same way. Purely mechanical work can be controlled more economically by lower nervous centres than by higher. In childhood and youth the nervous system is plastic, a prime condition for memorizing and fixing habits. Among the habits that should become ingrained during this period are those of correct bodily postures and activities, correct speech, the multiplication-table, spelling, writing, those involved in learning to speak foreign languages, etc. Most habits are controlled by the spinal cord which is early developed. Hence we should form habits early so that the brain may be relieved later of mechanical work and be concerned with higher operations. As Dr. Balliet has observed: "At first a child uses his brain in walking, later he can walk from habit and walks therefore with his spinal cord. As first we spell with painful consciousness, later we spell familiar

[1] *Essay Concerning the Human Understanding*, book III, chap. 10.
[2] *Op. cit.*, p. 248.

words of our vocabulary with little or no consciousness. Children ought to be trained to write and spell mainly with the spinal cord, and to use all their brain-power in thinking the thoughts to be expressed. We do many things with the spinal cord to relieve the brain. We walk with the cord, we write and spell with the cord; I suppose we knit and gossip with the spinal cord; indeed we may sing and pray, not with our hearts, nor with our brains, but with the upper part of our spinal cord. We tip our hats to each other, not with our brains, but mainly with our spinal cord; when we meet people whom we do not wish to see, we often shake hands mechanically with our spinal cord—hence we speak of a 'cordial welcome.'"

Not only do these elementary physical activities become automatic, but also processes of judging and reasoning must become largely mechanical before becoming serviceable. One's thinking is largely specialized and judgment outside of the well-beaten track of thinking is not very valuable. The lawyer's opinion concerning disease is slowly formed and unreliable; the doctor's judgment about legal matters likewise is valueless. The expert in a given line is one who has studied widely and who can form instantaneous judgments because of the habitual consideration of the data. Difficult studies pursued through a long time until mastery is complete become simple as the alphabet. Mathematicians become so familiar with the calculus that they read it for recreation when fatigued with other work. The lawyer can instantly cite scores of cases and precedents for which the tyro would have required hours to summon to the foreground of consciousness. Hence, when knowledge is to become usable it must be pondered long and every detail absolutely appropriated. To arrange work in such a way as to sustain interest through variety and at the same time dwell upon it until thoroughly comprehended and appropriated is high teaching art. The demands for variety frequently allure to new fields before assimilation has been effected.

I wonder if there is not much in modern student life that militates against the deepest thinking. With the multiplication

of student activities, of themselves in no way secondary to any others in importance, have not the opportunities for sequestered contemplation decreased? With foot-ball, base-ball, basket-ball, tennis, rowing, skating, the literary society, the dramatic club, the freshman banquet, the sophomore cotillion, the junior "prom," the senior "hop"; the numberless fraternity, sorority, and various house parties; the church, social, and other engagements, besides the loafing hour, the theatre, concert, special lectures galore, the newspapers and magazines to scan, the letters to write home and other places, applications for schools to make, etc., one might well exclaim: "And when do they find time to study?" In ancient times and in the Middle Ages the scholars shut themselves away from the world, quiet as it was, in order to avoid the distractions against thinking. While they erred in not recognizing that the senses are the source of all knowledge, were they not wise in recognizing that to think effectively demands solitude?

Many students take on altogether too many activities. In my own observation I have known several students who arrested their development badly by getting too many irons in the fire. A student's popularity is not infrequently the cause of his intellectual arrest. By attempting debates, athletics, dramatics, study, and society all at the same time, his energies are dissipated, his growth stunted, while his plodding companion by everlastingly keeping at a few things finally becomes a master and frequently astonishes even himself as well as his acquaintances. Even short courses with too much variety, except for inspiration, are uneconomical because they do not lay permanent foundations. Too many open lecture courses provided by faculties may easily be distracting and a source of dissipation. The student must learn to say no to the siren's voice which continually beckons him on to new fields.

I sometimes feel that there ought to be some course labelled "thinking" in which the individual should be isolated from everybody long enough to really empty his mind of all ideas which are merely echoes, and then to discern what are really

his own. With all the distraction of congested social life, the time may come when it would be a blessing for the State to imprison a few great men each year and allow them only pen, ink, and paper. It may have been a fortunate thing for the world that John Bunyan languished in prison until his thoughts had time to germinate and come to full fruition. Possibly the blind Milton, shut away from the distractions of visual stimuli, may have looked within and discovered thoughts struggling for expression, but stifled with the ephemeral ideas of sense perception.

While we are rightly emphasizing group activities as an aid in developing altruism, I wonder whether students do not sometimes misinterpret its meaning. Self-activity is fundamental in the process of acquisition of knowledge. No knowledge is of much value that is not made one's own personal possession. This means more than the recital of words and formulas gained from books and companions. In their desire to be helpful, I sometimes see students in groups, even sitting on the stairways where the crowds are passing, believing they are *studying* together. When one hears the bits of gossip interspersed between the formulas, the declensions, and historical dates one wonders where the calm reflection, deep concentration, analysis, comparison, doubt, contemplation, deliberation, complete abstraction, enter in. An over-social room-mate who persists in retailing the gossip of the day during the hour set apart for study is an uneconomical acquisition. Psychology has thoroughly demonstrated that we can consciously attend economically to only one set of ideas at a time. Even much note-taking in class is an uneconomical distraction. The faithful but misguided student frequently attempts to take down every word uttered. He deceives himself, for, what he hopes to carry under his arm, he should have in his head. No wonder that sometimes the less scrupulous one who cuts class and borrows notes instead of writing them fares about as well.

In student life it is important to thoroughly master a task as speedily as possible. To skim over a lesson and leave it without

mastery is wasteful. The process may be repeated a dozen times in this way and then be only half learned. Hence, "whatsoever thou findest to do, do it with all thy mind and with all thy heart and with all thy strength."

May I say a word on the ethics of cramming for examinations? The method is a delusion and a snare. Ideas are not grasped, associations are not made, brain tracks are not made permanent, and even though the student might pass an examination on such possessions, like the notes of an insolvent bank they are found to be worthless trash when put to real use. Instead of wisdom more to be prized than fine gold, such a process may leave one with only bogus certificates. Make your mental acquisitions absolutely your own while going over the subject day by day, take ten hours of sleep before every examination day, and the results need not be feared. In trying to gain possessions most economically and to make them most permanent, I give frequently the following recipe: Study your lesson as if you expected to teach it. When you can teach it to some one else you possess it. Frequently actually try to teach your lesson. If your room-mate will not submit, inflict it upon an imaginary pupil. Some one said: "I do not lecture to instruct others, but to clear up my own ideas." [1]

[1] See *The Popular Science Monthly*, vol. LXXI, September, 1907, where several of the preceding paragraphs were first published by the writer under the title "Some Ethical Aspects of Mental Economy."

CHAPTER XXIII

THE CONCEPT IN EDUCATION

Importance of the Concept or Universal Truth.—It has been well stated by McMurry that the concept is the goal of all instruction. This is true if we bear in mind as McMurry has done that there are moral truths as well as intellectual, and that all worthy truths should result in influencing action. Isolated percepts and detached facts are valuable only in so far as they form a nucleus or matrix out of which universal truths are evolved. Too much of teaching deals with unrelated facts and symbols of facts which do not lead to the production of instruments (the concepts) whereby new cases can be dealt with. The solution of a particular example in arithmetic is of no value unless it leads to the formation of a rule whereby others of a similar nature may be analyzed and solved. A particular experiment in physics or chemistry may be interesting, but unless it illustrates some principle or law it is of no great value. No great progress in foreign languages, or in the mother tongue, for that matter, could be made did not the learner arrive (not necessarily consciously) at laws and principles which are of general application. Even the child that says "I *runned* down the hill" has arrived at several general principles, one of which at least has exceptions. However, his mistake arises out of his correct application of a law which he has learned.

Psychological Meaning of the Concept.—If conceptual thinking is so important in teaching then it will be valuable for teachers to study carefully the meaning of the concept and the modes of promoting its formation. The concept differs from the percept in many important respects. The percept is particular, concrete, and in consciousness only when the object is

present to the senses. A concrete and specific copy of the percept is an image. When percepts of several individuals of the same class of objects have been received or when several separate percepts of the same thing have been received we gain a sort of composite image—something like a composite photograph. This has been termed a generic image or a recept. Percepts and images are ideas of individual things; are specific and concrete. The concept is an idea of a class. It deals with universals. The concepts of chair or house do not refer to particular chairs or houses, but to the classes of objects. When we think chair conceptually we are not concerned with a big chair or a little one, a dining-chair or a rocker, an oak chair or one of mahogany. When we have a concept of animal we do not think of a cat or a dog, a white animal or a black one, a ferocious one or a docile one. In all conceptual thinking the characteristics common to the class are included. As soon as we turn to some particular individual of the class we must think in terms of percepts or of images. The concept, however, cannot be imaged.

We must guard against the idea that a concept relates to material objects only or even that it is always represented by a noun. There are just as truly concepts of actions or relations. The predicate, as well as the subject, in any sentence expresses a conceptual idea. The same is true of every other element or part of speech. To understand the expression "The ink flows freely from my pen," it is just as necessary to understand the denotation and the connotation of "flows" as of ink or pen. Similarly the prepositional phrase "from my pen" can only be understood through the universal idea compounded from the many individual ideas that were first known through experience. Laws in physics and chemistry, rules in arithmetic and algebra, definitions in grammar, are all expressions of conceptual ideas. They do not necessarily represent concepts in the child mind. If he has begun with the definitions, rules, and laws and learned them verbatim, they do not stand for clear, definite, enlarged relational ideas. They are mere words, the counters of realities and not the realities. But if the elements connoted in the

expressions have been experientially known, their relations apprehended, and the whole knit together into a product which gives a new background for all subsequent experiences, then we may say that the concept has been experienced. In natural science the learner must through classification of ideas be continually forming concepts, not only of objects but of their manifold relations. These concepts must be ever subject to modification and revision through new experiences.

Genetic View of the Concept.—It should be clearly understood that a concept is not a psychical product with a fixed value or content. When one gets a concept of a given object he has not exactly the same idea as some one else who has a concept designated by the same name. The child's idea of horse is, for example, very different from the one possessed by the farmer, the veterinarian, the jockey, or the zoologist. In fact, each of these will have different ideas included in the concept. The jockey has all the fine racing points of the horse in his idea, while the zoologist thinks of the place in the animal scale to which the horse belongs. A given concept also changes in the mind of the same individual according to his experiences. One's childhood concept of a given thing is very different from his concept of the same thing when he becomes an adult. For example, a child is given a book containing pictures; he thereupon marks off that object from others and isolates it as a class. But as the years go by, if rightly schooled, he gradually enlarges his idea of book. He learns of the different bindings, different sizes, varying print, and more important for the idea of book, he learns of the different types of books judged by the contents. He finds that there are story books, reading books, arithmetics, grammars, histories, geographies, dictionaries, encyclopedias; books of fiction, travel, biography, and others in wonderful profusion. One's idea of book is never complete, but with the student ever enlarging.

How different the child's idea of carbon, when he has seen it exemplified only in a piece of coal, from the concept of the chemist who has studied it in its manifold relations. Every one

thinks he has a perfect concept of "home." However, let one try to describe the homes of the Cingalese, the Kaffirs, the Comanches, the Hindoos, or a king, and see whether he will not acknowledge that there are multitudes of individual ideas that could still be incorporated into his concept, thereby extending it. Let the ordinary person try to describe his concept of oxygen (which word he would say he understood perfectly) and see how narrow his concept, and even how vague. The one who has not studied chemistry can tell a little about oxygen. One of my adult students said he understood the word, knew that the substance was a gas, that plants and animals need it to sustain life. This was the expression of a very crude concept; one of very narrow content; but it was nevertheless a concept. Another student who had studied chemistry a little added that it was a constituent of water, of nitric acid, of sulphuric acid, and a few other acids; that it was a colorless, odorless, tasteless gas, and a few other facts. This student had a little fuller and more exact notion or concept of the substance. Suppose I had called upon a professor of chemistry? What he could have told me would make a book. His concept is vastly fuller and also more exact.

The child's notion of plants is one thing, the botanist's another; the child knows only a few facts and those indefinitely; the botanist multitudes of them, and those with exactness. The child has formed a few accidental, mechanical associations, for example, that all plants have leaves and lose them in the fall; the botanist has formed myriads of thoughtful associations relating to structure, function, use, and habitat. The child's generalizations concerning people are at first few and largely the result of chance associations. As he grows older he extends his range of acquaintances, discovering different types, enlarging his range of observations, drawing newer conclusions, revising old ones, thus constantly modifying and enlarging his concept of mankind. Before he becomes a sociologist, a statesman, or a leader of men in any capacity, his crude childish notions of society must undergo such transformation and metamorphism

that his specialized adult conceptions will no longer be recognizable as being related to the primitive ones. However, this is the only process whereby the rich, accurate, and completer notions could have been developed. The rate of growth may be sometimes faster, sometimes slower, but the stages must be passed through. Finished concepts can never be borrowed ready-made. They must grow and not merely by accretion of new material; but also by apperceptive integration.

The Curriculum and Concept-forming.—In the arrangement of our American school curricula we have had too little regard for the psychic laws governing the development of concepts. We have assumed that the child could learn all there is of a subject on the first presentation. Scarcely a secondary school subject but that is "finished" the same year it is begun. Geometry, which has some very simple fundamental ideas, is deferred until about the age of fifteen. It also has some very difficult conceptions and these are taken during the single year, or year and a half, devoted to it. Genetic psychology teaches us that it would be far better to begin the learning of simple geometric concepts many years earlier and gradually approach the more difficult ones, reaching the rigorous "original" exercises and the most difficult types of theorems much later than fifteen. We begin abstract formal grammar when the child should be utterly unconscious of the existence of parts of speech, syntactical rules, and declensions. Grammar is a study in psychology, a study of the forms, modes, and categories of thought. The child has not reached the age of serious reflection and has no interest in forms of thought because he does not consciously recognize them. Language is to him merely a mode of expression. He is interested in its grammar only in so far as he finds it necessary to centre upon it in noting his inadequacies of expression. As an object of scientific analysis it is one of the branches most poorly adapted to the needs of children. Botany, physics, and geology are a thousand times better adapted for study at that period. Even these should not too early be made subjects of rigorous scientific method. But, it is still true, that it is much

easier for the child to gain the concept batrachian, rosaceæ, and mollusk than those of noun, verb, and especially participle, infinitive, gerund, and modal adverb.

Arrangement of German and French Curricula.—The German and the French secondary schools are far superior to ours in the arrangement and distribution of studies. (I believe we are nearer right in the selection of the studies.) They arrange to have each study carried through a long period of time. History, for example, is carried through the entire course of nine years, two or three hours a week; natural science is carried through the entire course from two to three hours a week; mathematics through the entire course from three to five hours a week, according to the class of the school. Latin is begun in the fourth year of school life and carried seven or eight hours a week for nine years. In mathematics the order is not arithmetic, algebra, geometry, each in turn being finished before the next is begun. Geometry is begun in the sixth grade and has two hours a week devoted to it while arithmetic is accorded only two. The next year elementary algebra is introduced, literal expressions and equations of the first degree with one unknown quantity being taken. The work in the elementary inductions relating to plane figures is continued. Arithmetic is not abandoned but more difficult work is given in ordinary arithmetic. The algebra and the geometry are also correlated with it. In the ninth grade, or about the fifteenth year of life, logarithms and trigonometry are begun and continued as a part of the mathematical course for four years more. It is noticeable that such topics as interest and other difficult portions of arithmetic, and in algebra the binomial theorem and imaginaries, are deferred until the last year, which corresponds to about our sophomore year in college.

The history work is also arranged upon the spiral plan. The same facts are re-viewed many times in the course from different stand-points. At first the interesting narratives and biographical data, as mere facts, are learned. Later the knowledge of the same facts is extended and viewed in new relations. At a later

time more facts are added, new relations studied, classification of these facts and relations made, and the whole knit more firmly together. By the time the university is reached the student has a thorough grasp of the significance of the main facts, especially of the history of classical nations and of Germany, and is then ready for a philosophic treatment of the subject. "The psychological principle of repetition is thoroughly carried out in their history teaching. The work begins in the lowest grade and extends to the highest. They never feel that they

FIG. 40.

have 'finished' the subject. The same ground is continually crossed and recrossed, viewed from different stand-points and from positions where all can be surveyed; the relations of cause and effect thoroughly studied until all becomes a closely and firmly associated whole. The entire course forms a continuous and 'ever ascending spiral from the apex of which an outlook over the past is obtained.' They believe in learning much about a few things instead of a little about many. In this lies their greatest pedagogical strength."[1] The system might equally well be characterized as a system of concentric circles, in which each year the circle of thought in each branch or topic is larger than in the preceding period. The accompanying diagram

[1] Bolton, *The Secondary School System of Germany*, p. 250.

illustrates the plan. It should be noted that the beginnings of all the great fields of knowledge are studied in the elementary grades, and that each field is considered in some phase throughout the successive years.

Language and the Growth of Concepts.—There is an inevitable functional psycho-motor relation between ideas and expression, or between ideas and language. Consequently it is important for the teacher to understand the relation and also to understand ways and means of affording opportunities for their correlative development. If the relation is absolute it may be asked why consideration should be given to means of exercise? In discussing motor training in general it was shown that reactions need refining. Although some reaction is certain to occur, it is not necessarily the most desirable one. The amœba when stimulated moves, but the manner and direction are unpredictable. Likewise human beings when stimulated tend to express themselves, but the uneducated express themselves inadequately and uneconomically. Energy is diffused instead of being confined to special channels.

Whenever reactions to impressions become stereotyped so that a particular form of reaction is used in connection with a particular state of mind or body there is language. It may include gestures, bodily signs, or speech. This discussion will be confined mainly to vocalized speech. Speech is one of the most prominent modes of ideo-motor reactions in human beings. A great multitude of impressions issue in vocalized speech. Among civilized adults many impressions issue in the form of written language. With the development of conceptual thinking some symbols become necessary as a means of mental economy. To produce each perception or individual idea every time it needs consideration, or to revive even in concrete imagery every idea would be a tedious process, to say the least. Of course, it is impossible to form many ideas at all without recourse to a higher stage, *viz.*, abstract thinking. In order to isolate the concept and hold it before the mind it is necessary to associate some symbol or ticket with it which will make it stand out clearly

and also bind together the salient features. This is found in words, signs, symbols, formulas, etc.

At first the word has a limited meaning, standing for a single class of ideas, or possibly a single idea. Gradually it becomes associated with a variety of ideas or classes of ideas and becomes enlarged in meaning. Dr. Harris has suggested that words are like bags into which new treasures of a given class are constantly being poured. After long use a word is apt to become rich with meaning. But not only are words the symbols of ideas. They have even a much more vital relation. Because impression and expression are absolutely interrelated, because all thought has its motor aspect, words come to be an integral part of the idea. After an idea has been expressed by means of words the idea could no more be reinstated without thought of the word than the idea of skating could be thought of without reviving the idea of the appropriate movements.

Language an Index to Child and Race Development.—There is a direct relation between the growth of ideas in the child or in the race and the development of language. The race that is high in the scale of civilization is rich in ideas, and is possessed of a rich vocabulary. The full vocabulary is not only a resultant but a cause. The rich vocabulary has enabled the race to develop a rich store of concepts. In turn the acquisition of a rich variety of concepts has necessitated and stimulated the development of a large and expressive vocabulary. The size of the dictionary of a people is indicative of their racial status. The size of the dictionary is also predictable if one knows the mental capacity of the people.

Likewise the child's vocabulary is a good index to his range of ideas and activities. A child denied the privileges of country life, for example, will use a vocabulary unrelated to rural conditions. On the other hand the child's range and accuracy of ideas is very vitally conditioned by the acquisition of a suitable vocabulary with which to label, isolate, and reflect upon ideas he gains through concrete presentations. Many a country boy comes in contact with a vast array of concrete facts, but because

of lack of training to observe more analytically, to think more conceptually, and to integrate and clarify his concepts through language he remains uneducated in the highest sense. The lowest and foundational stages were experienced, but development was arrested upon the low plane.

The foregoing considerations point toward the necessity of wise training in language, both native and foreign. No course of study can wisely omit the expression side of the educative process. The slogan "ideas before words" should be stated, "ideas and words." Language training should be an integral part of every course in geography, history, mathematics, or any other subject. Some foreign language should also be a required part of the course of study, because of the clarifying and enlarging effects upon the vernacular. The little child says incoherent things, often moves his whole body instead of his vocal organs, and if required to think exactly writhes and twists his body, hesitates, stammers, and does anything but say the exact thing. It is wholly unpsychological to expect that a child shall express his ideas in refined language. That result is only possible after long training in speech. Some persons never acquire the skill. Clearness and accuracy of expression mean clearness of ideas and exact co-ordination between ideas gained and means of expression, and between these and the muscular organs. Gradually, through careful training in language, properly correlated with the acquisition of ideas and activities, the learner acquires the refinements of language which indicate clearness and precision of thinking. In the early stages of education, while the child is gathering sense impressions and laying the foundations for relational thinking, we must be content with many crudities of speech. Just as the child sees only externals and those often in incorrect relations, we must expect that his speech will be disconnected, distorted, abbreviated, and wholly crude and unrefined. With patience in teaching him to observe and to weigh and consider his expression, we may expect his concepts to become full, clear, and accurate, and his expression to become adjusted and correlated with them. The two must grow to-

gether, and it is futile to expect either to develop properly without the influence of the other.

The Statement of Concepts.—Although the importance of expression and language training have been emphasized, a caution needs to be suggested against the forcing of over-refined scientific statements before the concepts themselves have been acquired. It is easy to require children to memorize definitions and descriptions of things which they totally fail to comprehend. No definition should be committed to memory until its meaning is understood. A definition is a highly condensed statement of a concept. Since the expression of a concept is the final step in its acquisition, if memorized before understood it tends to close the mind against further analysis of the content. It therefore closes all avenues of acquisition for that particular idea. What is true of definitions is also true of rules.

It is a good thing to have summaries and outlines made—by the pupils themselves. If stereotyped summaries and outlines are learned they tend, like definitions, to close the mind against further search for content and meaning. An outline presented at the beginning of a subject or topic should never be memorized at that stage. It may be presented as a sort of guide-board to indicate the direction to be followed, but it is detrimental if considered as the full expression of the concepts themselves. The most valuable outlines and summaries are those made by the learners themselves. It is especially important that advanced students be required to organize the materials which they have acquired. Unless required to do so they, like children, tend to depend upon verbal memory, and frequently deceive themselves and their instructors by the expression of knowledge which is vague and meaningless to them. Even though the summaries made by the learner himself may be less finished than those given by the instructor and memorized in form by the learner, they are far more valuable than any that are borrowed ready-made. The summaries made independently by the learner indicate what he knows—his concepts—while those memorized from another show what the teacher knows and the pupil is able to echo.

Scientific Classification and Organization of Knowledge.—Important as it is to have knowledge classified in an orderly and scientific manner, a caution should be observed against over-emphasizing this with beginners. The child mind is not scientific in its tendencies. It is absorptive, acquisitive, but not orderly. The interest and the attention of the child are flitting and undoubtedly this is necessary for normal growth. Too long-continued attention in any direction causes over-tension and one-sidedness of growth, because of the great plasticity at that age. It is a great mistake to over-emphasize system, classification, or refinement of expression in childhood. It is sure to kill interest, spontaneity, and self-activity and to produce arrest of development in some direction or other. We must remember that one of the very causes of instability is the struggle of instinctive tendencies to assert themselves. While we are causing the child to fix absolutely certain forms and formulas, we are probably stifling the expression of many desirable instincts and making him lop-sided in other directions. Any teacher who has tried to teach nature study to children from a book, logically and scientifically arranged from the adult point of view, has undoubtedly made a failure of it. Even in the grammar school and the high school there is great danger of over-emphasizing the purely logical side of the studies. There is too much anxiety to have everything systematized and ticketed when the pupil leaves a course at any point. What will be the harm if pupils do not "finish" a given "course" in history, geography, or physics? Who can say what "*the* course" should be in any one of them? In different countries, in different localities every one of them may differ very materially in content. When a student studies history in college he certainly ought to organize the subject thoroughly, but before that time it is far more important that he gather facts and acquire a headway of interest.

We may go so far as to maintain that with beginners in any grade of school, and even in college, there is great danger of over-emphasis of classification and systematization of knowledge. To classify and organize there must be something to classify and

organize. The beginner in economics, chemistry, psychology, or the theory of education, for example, needs to go through a gathering period before devoting too much attention to systematization and organization, no less than does the child in the kindergarten. The genesis and growth of the concept demands it; and organization means relatively finished expression of concepts. Of course, the teacher should proceed in an orderly, systematic manner, but it is fatal to spontaneous growth in the learner if he becomes too conscious of the method by which he is acquiring. He should be absorbingly interested in the ideas or activities acquired and relatively oblivious of the method of acquisition. Even the teacher must be guided much more by the psychological unfolding of his pupils' minds than by logical categories.

CHAPTER XXIV

INDUCTION AND DEDUCTION IN EDUCATION

Inference.—The drawing of conclusions from given data is termed inference. The mind may move in either one of two directions in drawing inferences. It may begin with particular data, isolated cases, and attempt to determine the general law which governs all of the class and seek the necessary relationship which exists between the cases which seem to fall into a class; or it may take the general law and apply it to a particular case. In either instance the relationship existing among the ideas or the phenomena is what is sought. "The purpose of an inference is always the same; namely, to exhibit the relation and connection of particular facts or events in virtue of some universal law or principle. In deductive thinking, such a law is known, or provisionally assumed as known, and the problem is to show its application to the facts with which we are dealing. In induction, on the other hand, the starting-point must be the particular facts, and the task which thought has to perform is to discover the general law of their connection. Both deduction and induction play an important part in the work of building up knowledge." [1]

Meaning of Induction.—In every-day life we employ a great many words which denote concepts. Many of these classifications of objects, laws, rules, and relations we have not worked out for ourselves but have taken second-hand. Somebody, however, has had to work them out. Occasionally we derive independently from given data which we possess a new law, or rule, or classification. This process of arriving at generalizations

[1] Creighton, *An Introductory Logic*, p. 173.

through a consideration of particulars we term induction. It is a process of deriving generalizations from particular cases or of passing from the particular to the universal through the particular. It is essentially the process of developing concepts from and through individual experiences.

It is frequently stated that induction is a process of passing from the particular to the general, but it should be understood that a real induction involves the derivation by the mind of a conclusion or a judgment from these particulars under consideration. Induction is a process of *thinking*, a process of *reasoning*, and unless the mind weighs, compares, and comes to a conclusion *from the data* involved there is no induction. To consider this book and then that book and then all books, for example, is not necessarily induction. It is only such if the mind arrived at a *generalization* applying to all books or a class of books through the contemplation of the particular books.

Illustrations.—Here is an apple blossom with five petals. I examine several others, and finding the same number in each and that the arrangement is regular I conclude that there are five petals on every apple blossom. People saw a good many swans all of which were white, and the belief that all swans were white became firmly fixed. We now know, however, that there are black swans. But as long as only white swans had been seen the former conclusion was a legitimate induction. For thousands of years people believed the earth to be flat and plate-shaped. They arrived at these conclusions just as we should do in case we had not been taught differently. We never noticed evidence of its sphericity, and from every point of view the line of meeting of the earth and sky seems to form a circle and we seem to stand in the centre of the circular plane surface.

When the child first perceives things they are experienced as isolated things without relationship or laws. Gradually as experiences multiply they seem to occur in regular orders and sequences, and connections seem to obtain among various things. These experiences gradually become classified and arranged according to laws apparent to the child. This is precisely what

occurs when the adult views new experiences. At first each occurrence is viewed singly, but as other phenomena occur they gradually become classified. The main difference here between the child and the adult is that the adult mind arrives at more general laws, which are more correct, and instead of mere chance associational bonds that assist in classification the adult seeks and finds more causal relations. However, the ordinary adult is far from being critical and accurate, and many generalizations are incorrect and even absurd. It is only the careful scientist who is able to make correct inductions. Even many of his conclusions are apt to be very imperfect and need continual revision. The true scientist is cautious about dogmatic assertions and waits until sufficient evidence is collected before proclaiming his beliefs. Darwin, though believing in certain conclusions for a long time, was willing to collect materials and to observe for thirty years before publishing his conclusions to the world.

Classes of Induction.—There are usually two classes of induction spoken of by logicians; perfect induction when all possible cases have been examined, and imperfect induction where only a limited number of individuals have been examined and a conclusion is derived from this number. The distinction seems almost superfluous, for in reality there are very few cases where all the individuals can be examined. Nor is it necessary to examine all cases. It is not the number of cases but the discovering of the *necessary relationships* that constitutes the essence of inductive reasoning. The untrained individual often thinks he has made complete enumerations—all the cases that he has noticed having exhibited certain characteristics. The fault with him is (1) that he has noted merely contiguous or chronological sequence and not real relations, or (2) that because of prepossessions prejudicing his mind he has failed to observe cases not in accord with his theories. What he has really done is to form an hypothesis for a single instance and then to enumerate instances that support his crude theory. And because of his uncritical and easily biased mind he perceives only the instances that support his hypothesis. Some farmers, for example, are

sure that three white frosts bring a rain; that planting potatoes in the new of the moon makes them grow better; and that toads and earth-worms rain down. The savage believes that spirits eat the food which is left in the forest for their propitiation; he resorts to charms, incantations, and sorcery in the cure of disease; and he continually ascribes anthropomorphic causes to natural phenomena. The child likewise is anthropomorphic, and continually comes to erroneous conclusions. All such conclusions are arrived at because of imperfect induction.

Creighton gives as a case of so-called perfect induction, the conclusion that all months of the year contain less than thirty-two days. He believes, however, that cases like this where results can be summed into an absolutely correct general proposition are not necessarily induction. Induction does not merely aim at the summation of particular instances. But "the real object of inductive inference is to discover the general law or principle which runs through and connects a number of particular instances." He admits that "It is, of course, true that we shall be more likely to obtain a correct insight into the nature of the law from an examination of a larger number of cases than from a small number. But the discovery of the principle, and not the number of instances, is the main point. If the purpose of the induction, the discovery of the universal principle, can be adequately attained, one case is as good as a hundred." [1]

By mere enumeration we may gain certain aggregate facts, but it is only when we classify these facts, *i. e.*, consider relationships and group according to relationships that there is genuine induction. These relationships must also be more than accidental; they must be necessary relations—conditions that would obtain if the group became larger, conditions which one could prophesy for the group however much extended. Real inductive processes consider the why as well as the what and the conclusions are based upon the necessary relations. There is not necessarily any induction in taking a census, although a census should afford data for many inferences.

[1] *Op. cit.*, p. 188.

Children's Inductions.—Children do much more thinking than they are credited with. Much of their thinking has one characteristic of scientific thinking, *viz.*, independence. Their judgments are apt to lack accuracy because they jump at conclusions before gaining sufficient data and they do not try to verify them. Many of their conclusions, however, are better illustrations of genuine inductions than the echoings of some older people. My boy of four said one cold day on reaching a park: "Let us hurry for it will be cold here." I inquired why. "Because the trees make the wind blow," he replied. G., a girl of five, brought me some elderberry blossoms and asked: "What are these? What becomes of them?" She was told that they become fruit. "Then, do cherries have blossoms before the cherries grow?" she inquired. "Yes," I said. "Do apples have blossoms?" "Yes." "Do all fruits have flowers first?" Then came the statement: "There will be no berries if we pick off the flowers." Here we have a perfectly definite chain of induction, and the conclusion was independently drawn from the data at hand.

When the child says, "I runned," "I singed," "I hurted myself," etc., he is applying conclusions reached inductively. The course of reasoning is not a conscious process, but is just as unerring as if it were a matter of deliberate analysis and synthesis. Many misspellings are the result of reasoning based upon analogies. Certain values are learned for given letters and the inference is drawn that the same values will always obtain. The misspelling is not the result of illogical reasoning, but quite the contrary. The following actual mistakes illustrate the point advanced: *meny*, *sed*, *peeple*, *mutch*, *eny*, *lern*, *axadent*, *suckseed*, *ashure*. To spell correctly many words of the English language one must be able to disregard logic and remember isolated combinations of sounds.

The child, like the savage, is anthropomorphic and soon learns to ascribe very concrete causes to actions not visible and to forces not understood. For example, the wind is caused by some one waving a big fan; the rain comes down because some

one has made holes in the sky; lightning is caused by God lighting the gas quickly; thunder is the sound made by a wagon in the sky, or sometimes it is God groaning or walking on the floor, etc. Children develop their own unique ideas on moral questions. They are quite certain to conclude that acts which are forbidden are wrong and that all not forbidden are perfectly right. Through our injudicious methods of correction they are apt to conclude that sin consists not in the doing of certain things, but in getting caught. Thus the "protective lie" comes to be resorted to and believed to be right. Children's inductions concerning the Deity, religion, time, the self, distance, etc., are all very naïve, but strikingly independent of authority.[1]

It is a sad commentary that when the child begins school he begins to surrender much of his independence of thinking. Being set to learning books instead of continuing with the world of objective reality, he soon learns to rely on authority instead of upon the evidence of his own senses. Again, his questionings are silenced by our methods and he ceases to be an alert inquirer while in school. The teacher frequently does all the interrogating and marks him down for wrong answers and for ignorance displayed by his questions. No wonder that he subconsciously arrives at the induction: "It pays to be silent and to expose as little ignorance as possible." Verbatim memory for the day comes to be the best-paying capital.

Examples of Induction in Teaching.—Some examples are adduced which illustrate the utilization of induction in the teaching arts. The discussions here are necessarily much abridged.

Take a tube which is nearly full of water and blow into it. A sound of a certain pitch is produced. Lengthen the tube by pouring out part of the water and a lower tone is produced. Pour out still more water thereby lengthening the tube and a still lower tone is produced. What may be concluded from

[1] For some splendid collections of illustrations, see Sully, *Studies of Childhood*, chaps. 3, 4; his *Children's Ways*, chaps. 4, 5, 6; Brown, H. W., "Thoughts and Reasonings of Children," *Ped. Sem.*, 2 : 358–396; Hancock, J. A., "Children's Ability to Reason," *Ed. Rev.*, 12 : 261–268; Barnes, Earl, *Studies in Education.*

this experiment? That the longer the tube the lower the tone; the shorter the tube the higher the tone.

The laws of decimal fraction notation and numeration may be discovered and stated by pupils themselves. Presupposing that the decimal notation for integral numbers is understood, the following questions may be asked concerning the expression 11111: What is the value of the second figure from the right as compared with the first 1? *Ans.* Ten times as great. The third with the second? The fourth with the third, etc.? What is the name of each order? Now, how does the third figure from the right compare with the fourth? The second with the third? The first with the second? What would be the value of the next order to the right as compared with the first? *Ans.* One-tenth. The next? *Ans.* One-hundredth. What should be the name of each? Now we place a point between the whole number and the fraction to indicate the separation. How read 1? If I place a point to the left of it, what does it become? 11.1, how read? .1, how read? .11, how read? etc.

The rule for pointing off in multiplication of decimals may be taught inductively. Presupposing a knowledge of writing common fractions as decimals we may proceed as follows: Write the decimals first as common fractions.

A.
$$\frac{5}{10} \times \frac{5}{10} = \frac{25}{100} = .25$$

$$\frac{5}{10} \times \frac{5}{100} = \frac{25}{1000} = .025$$

$$\frac{3}{100} \times \frac{2}{100} = \frac{6}{10000} = .0006$$

Now writing the decimal forms we have:

B.
$$\begin{array}{r} .5 \\ \underline{.5} \\ 25\ ? \end{array} \qquad \begin{array}{r} .5 \\ \underline{.05} \\ 25\ ? \end{array} \qquad \begin{array}{r} .03 \\ \underline{.02} \\ 6\ ? \end{array}$$

Because the expressions in A and B are equal, their products must be equal. Then compare the number of places in the mul-

tiplier and multiplicand together, in each case with the number in the product. Pupils have no difficulty in formulating the rule.

The following illustration shows how the learner may arrive at the rule for finding (*a*) the area of a rectangle, and (*b*) the area of a triangle. Draw a rectangle, for example, one that represents a surface of 6 ft. x 4 ft.

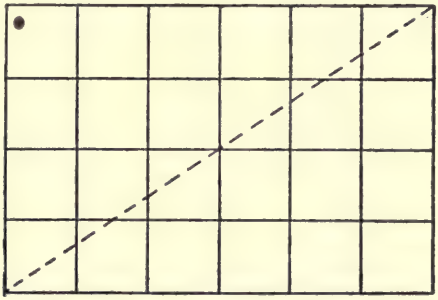

FIG. 41.

(*a*) Divide it into squares. How many squares in the upper row? *Ans.* Six. How many in the next? *Ans.* Six. How many in each row? How many rows of squares? *Ans.* Four.

Then if there are six squares in each of four rows, how many squares? *Ans.* Twenty-four squares. State how you found this. *Ans.* By multiplying six squares by four. What do each of the six squares represent? *Ans.* A square foot. Then state the rule for finding the area of a rectangle. By this method it will easily be seen that we obtain square feet because we started with a square foot as the unit. Similarly the rule for finding the cubic contents of a rectangular solid can be developed. In fact, practically all of the rules in the mensuration of surfaces and solids can be thus built up.

(*b*) Draw a diagonal of the rectangle and ask: How do the two parts of the rectangle produced by drawing the diagonal compare in size? It is manifest that they are equal. What part of the rectangle is each of the triangles? How does the base of each triangle compare with the length of the rectangle? *Ans.* They are equal. How do the heights or altitudes of the

triangle compare with the width of the rectangle? They are equal. State again the rule for finding the area of a rectangle. Then, how shall we find the area of each triangle? State the rule for finding the area of any right triangle, when base and altitude are given. This could be extended so as to hold for any triangle.

Examples from algebra are very easy to find. By actual division get the following results:

$$a^2 - b^2 \div a - b = a + b$$
$$a^3 - b^3 \div a - b = a^2 + ab + b^2$$
$$a^4 - b^4 \div a - b = a^3 + a^2b + ab^2 + b^3$$
$$a^5 - b^5 \div a - b = a^4 + a^3b + a^2b^2 + ab^3 + b^4$$
$$a^{10} - b^{10} \div a - b = a^9 + a^8b + a^7b^2 + a^6b^3 + a^5b^4 + a^4b^5 + a^3b^6 + a^2b^7 + ab^8 + b^9$$

What is the nature of the dividend? *Ans.* The difference of like powers of the two numbers. The nature of the divisor? *Ans.* The difference between the two numbers. Are all of the given dividends divisible by $a-b$? Do you think $a^{100}-b^{100}$ divisible by $a-b$? a^x-b^x and a^n-b^n by $a-b$? Do the last belong to the same class as the first? State what you believe to be true, *i. e.*, the *law* or *rule*. Proceed in a similar manner to develop the law of exponents, number of terms, etc., in the quotient.

As another illustration take the following:[1]

What does $a^2\ a^2\ a^2$ equal? What then does $(a^2)^3$ equal?
What does $a^3\ a^3\ a^3$ equal? What then does $(a^3)^3$ equal?
What does $a^4\ a^4\ a^4$ equal? What then does $(a^4)^3$ equal?
What does $a^5\ a^5\ a^5$ equal? What then does $(a^5)^3$ equal?
What does $a^n\ a^n\ a^n$ equal? What then does $(a^n)^3$ equal?
What does $a^n\ a^n\ a^n\ a^n$ equal? What then does $(a^n)^4$ equal?
What does the product of r factors each of which is a^n equal?
What does $(a^n)^r$ equal?

The *rth* power of the *nth* power of a number is equal to the *nrth* power of that number; this is expressed in the formula $(a^n)^r = a^{nr}$.

[1] From *A School Algebra*, by C. A. Van Velzer and C. S. Slichter, p. 164.

In the ordinary Euclidian geometry taught in the high schools the method to be followed is deductive and not inductive. (Unfortunately it is often taught neither inductively nor deductively, but is mere memory work—all on faith.) Undoubtedly the deductive geometry should be taught in the high school, but it should have been preceded by a course in inductive geometry. An example of the inductive method in geometry may here be mentioned to illustrate the point of view. Measure each of the angles of several given triangles and compute the sum of the angles in each triangle. The class may measure a good many and give their own conclusions. This is *not original* investigation for the teacher sets a definite problem and shows the means for its solution.

Geography is an excellent subject for exercises in inductive thinking. All the general notions of commerce, occupations, trade relations, and of natural features should be built up objectively as largely as possible and arrived at through the consideration of specific illustrations. The *definition* of a mountain, an island, or a railroad system should be among the final steps in geographical study rather than the first. However, the general notion should have been growing gradually through the consideration of individual instances illustrating each. Physical geography offers opportunity for the exercise of more difficult inductions involving cause and effect.

History in its elementary phases is a subject which deals with facts which are to be learned for the purpose of later deriving generalizations. It cannot be divided up into sections each of which leads to a law or principle. It is difficult to state exactly the generalizations of history, and the lessons that may be learned become larger and broader with the increase of one's knowledge of the facts. Its generalizations are much less definite though real. The ideas gained from history are at first much more isolated. The larger concepts are necessarily of slow formation and the teacher should not force the process. He should at first be content if interest is secured and a rich fund of facts accumulated, even though loosely organized.

Order of Instruction.—The teacher knowing that the inductive process is the natural order in which the mind moves, will arrange his instruction so as to further the habit and to assist in securing as a habit what is not very natural, a critical evaluation of data. This does not mean that teachers should never *tell* anything. To know when to tell, what to tell, and how to tell constitute high teaching art. But the order should be one of inductive unfoldment of ideas; a skilful marshalling of facts, propounding of questions, and leading the learner to draw conclusions for himself as far as possible. Reasoning either by induction or deduction means *deriving relational* knowledge. Merely gathering facts without establishing new relations among them is not reasoning at all.

Now notice that usually the rule is stated at the outset, the pupil told to learn it and then given examples for practice. By that procedure he is not trained in reasoning but merely in *computing, according to rule.* Proof should come at some stage, but that is much harder. That should be considered under deduction. He should be trained to *think* and to work from principles rather than from rules.

Relation of the Text-book to Induction.—Some have contended that text-books ought to give generalizations only; others that they ought to give the detailed facts but omit the generalizations and rules, leaving these to be worked out by pupils, with the teacher's help. In the first kind of book the particulars would need to be supplied by the teacher. This works fairly well in some subjects with skilful teachers. For example, an arithmetic on this plan would begin each case with the statement of the rule and then follow with examples and problems for application. All preliminary illustrative material would be omitted. Such a book in the hands of a poor teacher would be very uninteresting and difficult. Many of the text-books in the German schools are of this type. Even in geography there is the merest outline and a summary of generalizations. Geographies in this country have been of this type, but the newer ones furnish much material. The ones which furnish more material

are manifestly more desirable than those which are merely boiled-down summaries. Only the teacher with an abundance of time and equipment can furnish the many details necessary. Even then the well-written text-book has the materials better selected and arranged than can be done for a particular class by most teachers.

A book of facts with the generalizations omitted is often to be found in our newer arithmetics. They are better than the book with only the generalizations. However, in unskilled hands they produce chaotic results. Knowledge needs classification and ticketing in order to be usable. The rules and generalizations fulfil the same functions as words. They help to isolate knowledge, to classify it, and to form a centre about which to group new related knowledge. A good text-book contains plenty of material. This material should be arranged in a logical sequence, selected according to psychological needs, and in such a way that the learner who follows the discussion thoughtfully foresees the generalization before reaching it. The book statement of the generalization should, of course, be the best, and be calculated to clarify and enlarge the learner's notions. In many cases the teacher may go over the same lesson orally before assigning the text to be read. The book is then used to clarify and impress the knowledge more firmly. In other cases the pupils may safely be set to work out the lesson themselves. A book properly arranged meets their apperceptions and furnishes the data necessary for the development of every generalization. Every good text-book for older pupils should be so arranged that the learner could use it to good advantage without a teacher. With a teacher, he should be able to use it to still better advantage.

But back of the text-book in most subjects there must be objective experiences gained at first hand. The understanding of the text-book is made possible only when it calls up personal observations and experiences. To be sure, the new whole need not have been experienced, but the elements composing the new whole must have been. In the material sciences laboratory ex-

periments and demonstrations should make clear each step whenever possible. From the very nature of mind it is necessary that the elementary notions in all subjects should be built up objectively.

Importance and Use of Inductive Methods.—What will the pupil gain by being required to form conclusions for himself? In some cases results would be secured more quickly by simply giving the rule and requiring him to apply it. For example, the rule for pointing off in decimals can easily be committed to memory and its application learned without understanding a shadow of the reason therefor. The pupil could quickly learn to perform the operation without mistakes and undoubtedly would remember it as long as if acquired in a more laborious manner. Then what is gained by the more laborious process? Nothing, provided computation is the only end in view. But if arithmetic is to be "a study which trains the reasoning powers," the pupil must use it as a means of reasoning. To learn "that he must invert the terms of the divisor and multiply" is a mere act of memory and involves no real thinking, but to know why he does involves thinking to a high degree. We wish to inculcate *habits* of inductive reasoning.

Every successful man is a good inductive reasoner. The professor in a science has no monopoly on induction. The business man has equal need of forming independent conclusions from every-day data. The merchant, the banker, any financier must watch daily factors that are liable to affect the markets, and from these factors they must draw conclusions as to the course of procedure. No rule can be laid down that will infallibly guide, for exactly the same factors never enter into combination twice. Hence each set of factors should lead to independent conclusions. Since the mind works according to habits acquired, it is of the highest importance to give the mind in early life as strong a tendency as possible toward inductive thinking.

The dry-goods merchant to be successful has to determine carefully in advance what kinds of goods to purchase for the

coming season. He must be guided by the experiences of past seasons and by the present conditions of trade, and by all the factors that affect trade. The past season will tell him whether woollen or cotton goods sold best, and what grade, and the quantity. The present condition of the money market will enable him to *guess* how freely people will spend their money; local conditions, as taxes and philanthropic enterprises, will enable him to guess how much money will be diverted into other channels and how much may be left to purchase from him. He must consider the growth of the population of his trade district, also the number of competing merchants who have moved in or away from his neighborhood; and Dame Fashion must be consulted for changes of styles. Besides these a host of other factors enter most intimately into the trade relations to affect the amount and the quality of the stock to be purchased. The merchant who can look ahead, foresee advantages and disadvantages, is the successful one. That is, the one who makes the widest, most careful inductions is generally the most prosperous. It often takes a year or years to prove the truth or falsity of the generalizations which he makes, and the bits of evidence collected in testing his theories are made the basis of new generalizations.

The United States Weather Bureau makes its daily forecasts from the data relating to barometric and thermometric readings, wind velocities at different points, and the various changes in temperature, atmospheric pressure, humidity, etc. The forecasts are simply inductive conclusions asserting probable conditions. The judge on the bench, or the jury listening to a trial has problems of induction to deal with. The testimony of witnesses is to form the basis for generalizations, or, in other words, it contains the individual notions used in forming the general notions. Similarly in every occupation there is opportunity and necessity for arriving at new conclusions through the consideration of particular cases. True, in many cases the mind cannot isolate the data as clearly nor draw as definite conclusions as in mathematical problems. But even in the most "off-hand"

guess the mind subconsciously generalizes from data which have been previously gathered. Even our unexplainable prejudices are results of induction.

Therefore, how important that the pupil be trained in the careful collection of evidence and in weighing it accurately before jumping at conclusions! The person who habitually decides things too hastily and then spends his time regretting his conclusions, reasons inductively no less than the one who arrives at a safe conclusion, but the induction of the former is imperfect.

Pupils, as well as scientists, should be taught to form hypotheses to account for certain phenomena. Hypotheses are guesses, but good guesses based upon a thorough knowledge of the conditions entering into the problem. The hypothesis should be (1) conceivable in the light of the facts; (2) it should be in accord with the facts; (3) it should explain the known facts; and (4) should be of such a character that inductions can be made from it. When hypotheses have stood the fire of criticism and have become well established they are termed theories. The atomic theory and the nebular theory were simply hypotheses or guesses which seemed to account for certain phenomena or relationships that existed, and from these guesses much actual progress in further knowledge has been made possible. The theory of a universal ether was at first propounded as an hypothesis attempting to explain some problems concerning the passage of light and heat rays. There were certain apparently demonstrated facts demanding explanation. The hypothesis which was put forth presented astounding difficulties of conception, but it has proved so valuable in working out practical applications and its proof has been apparently so incontrovertible that it has long been a well-accepted theory. Even now, however, new hypotheses and theories looking toward the explanation of many of the phenomena of heat and light are being propounded.

Huxley writes:[1] "The mental power which will be of most importance in your daily life will be the power of seeing things

[1] *Science and Education Essays*, p. 96.

as they are without regard to authority; and of drawing accurate conclusions from particular facts. But at school and at college you shall know of no source of truth but authority; nor exercise your reasoning power upon anything but deduction from that which is laid down by authority." Again he says:[1] "No boy or girl should leave school without possessing a grasp of the general character of science, and without having been disciplined, more or less, in the methods of all the sciences; so that, when turned into the world to make their own way, they shall be prepared to face scientific problems, not by knowing at once the conditions of every problem, or by being at once able to solve it; but by being familiar with the general current of scientific thought, and by being able to apply the methods of science in the proper way, when they have acquainted themselves with the conditions of the special problem."

Further:[2] "If the great benefits of scientific training are sought, it is essential that such training should be real: that is to say that the mind of the scholar should be brought into direct relation with fact, that he should not merely be told a thing, but made to see by the use of his own intellect and ability that the thing is so and not otherwise. The great peculiarity of scientific training, that in virtue of which it cannot be replaced by any other discipline whatsoever, is this bringing of the mind directly into contact with fact, and practising the intellect in the completest form of induction; that is to say, in drawing conclusions from particular facts made known by immediate observation of nature."

He further observes[3] that "It allows the student to concentrate his mind upon what he is about for the time being, and then to dismiss it. Those who are occupied with intellectual work will, I think, agree with me that it is important, not so much to know a thing as to have known it, and known it thoroughly. If you have once known a thing in this way it is easy to renew your knowledge when you have forgotten it; and when you

[1] P. 122. [2] P. 126.

[3] P. 251.

begin to take the subject up again, it slides back upon the familiar grooves with great facility."

Much school work smacks strongly of scholasticism which Sir Francis Bacon very aptly characterized:[1] "This kind of degenerate learning did chiefly reign among the schoolmen, who having sharp and strong wits, and abundance of leisure, and small variety of reading, but their wits being shut up in the cells of a few authors (chiefly Aristotle, their dictator), as their persons were shut up in the cells of monasteries and colleges, and knowing little history, either of nature, or time—did, out of no great quantity of matter and infinite agitation of wit, spin out unto us those laborious webs of learning which are extant in their books. For the wit and mind of man, if it work upon matter, which is the contemplation of the creatures of God, worketh according to the stuff and is limited thereby; but if it work upon itself, as the spider worketh his web, then it is endless, and brings forth, indeed, cobwebs of learning, admirable for the fineness of thread and work, but of no substance or profit."

The Deductive Method.—In the deductive process a generalization is the starting point and conclusions which accord with the generalizations are drawn concerning particular cases. To take the classical illustration: All men are mortal; Socrates was a man; therefore Socrates was mortal. Or, All names are nouns; John is a name; therefore John is a noun. The deductive process assumes that through a process of induction a generalization in the form of a law, rule, definition, or principle has been derived and then new cases are measured by the generalization assumed. In the ordinary Euclidian geometry usually studied in our secondary schools the theorem is the generalization assumed. Although the pupil takes this generalization as the beginning and proceeds deductively to test its truth or falsity, some one undoubtedly discovered the theorem inductively.

It is very important that the pupils learn to test results which they reach inductively or which are furnished them ready-made.

[1] *Advancement of Learning*, 14 : 5.

It is only by verification that the learner should come to a feeling of certainty and security in his own inductive conclusions. He should also learn to weigh, test, and verify statements furnished him by his teachers and his books. There is no certainty that when a pupil has reproduced correctly a demonstration in geometry which he has been set to learn that he has really gone through a process of deduction. He may have approached it deductively and learned the forms, but real deduction means reasoning, in which the individual derives the conclusions for himself. To follow another's deductive discussion is not to reason deductively; it is not necessarily reasoning at all.

High-school geometry furnishes the best illustration of the deductive method. The learner starts with the theorem and is asked to prove the truth or falsity of it. If he works out the course of reasoning for himself he reasons deductively. If he memorizes the printed discussion he follows a deductive method, but he does not necessarily reason. The fact that the discussions are fully written out in most text-books on geometry militates against securing the most efficient work in reasoning. The plan of the books fosters pure verbal memorizing. If only a few hints were given much better thinking would be stimulated. The "original exercises" are usually the best part of the books, but too often omitted.

Although deductive methods are more easily apparent in geometry than in other subjects, yet they are continually being employed elsewhere. Whenever definitions, laws, and principles are stated and then tested, or when applications are made of the laws and principles the deductive method is used. Grammar has most usually been taught by this method. Latin and Greek are quite universally taught deductively. In American schools the modern, foreign languages have generally been taught by the translation method, which is deductive in its approach. The pupil learns his definitions and rules, and then applies them to the particular words. Algebra and arithmetic have been taught more deductively than inductively, but even more as a matter of memory and by rule-of-thumb methods. Both of the subjects

are excellent instruments for utilizing reasoning processes, but when a rule is followed blindly, reasoning is used only meagrely.

Neither induction nor deduction should be followed exclusively in any subject. The foundations should always be laid inductively. Induction is a method of discovery, of investigation; deduction a method of testing, of proof, of application. After principles, laws, hypotheses, conclusions have been derived through a personal examination of particulars, they should be carefully tested and proven either valid or incorrect. It is a mistake to teach sciences by inductive methods alone. Induction without deduction tends to lead learners to jump to conclusions. They develop a commendable habit of making independent observations, but the observations are apt to be loose and inaccurate. When deductive methods only are employed, the learner is apt to become absorbed in logical abstractions, too much inclined to reason out conclusions from insufficient data. The middle-age scholasticism was characterized by the excessive use of the deductive methods and a meagreness of investigation. The reasoning was correct and fine-spun, but often based on unsound premises. The combined use of both methods characterizes all good teaching and all effective study. In advanced classes the deductive approach often seems to characterize most of the work, while in reality the approach is also inductive because the students have formerly gathered so many individual ideas that they need but to form or perfect their generalizations from the individual data. This is true in such subjects as economics, institutional history, and psychology.[1]

[1] For further discussion of induction and deduction, see, De Garmo, *Principles of Secondary Education*, vol. II; Bagley, *The Educative Process;* McMurry, *The Elements of General Method;* McMurry, *The Method of the Recitation.*

CHAPTER XXV

EMOTIONAL LIFE AND EDUCATION

Meaning of Feeling.—The word feeling is used in a popular sense and in a technical sense. We must distinguish carefully between the two meanings. When one says, "I feel cold"; "I feel the wind blowing upon me"; "I feel the contact of my pen upon my skin"; "I feel the weight pressing down upon me," etc., he does not use the term feeling in a strict psychological sense. He means rather that he has experienced *sensations*, of cold, contact, touch, weight, etc. "I sense it" or "I perceive it" would be more accurate expressions. But the expression "I feel," much like the expression "learning by heart," has come to us traditionally, and like many traditions it is difficult of dislodgment. When one says, "It feels painful," "It feels pleasant," "I feel sad," "I feel happy," "His heart throbs with patriotic feelings," etc., the expressions are being used to denote a different mental state from the ones indicated in the beginning of this paragraph. The word in the former referred to perception, to intellectual processes. That is, it was incorrectly used to designate ideas gained through the *sensation* of touch. In the latter cases it refers not to sensations or perceptions, but to the pleasure or repugnance connected with those intellectual states. Hence we may define feeling as the simple, pleasurable or painful side of any simple mental state; or, as Sully has expressed it, "feeling marks off the pleasure-and-pain 'tone' or aspect of experience."

The lower forms of feeling are difficult to distinguish from sensations. For example, in hunger just what is sensation and what is feeling? The distinction must be personally experienced, "felt," in order to be appreciated. No formal word definition will make it clear. In the realm of the higher feelings or emo-

tions it is easy to distinguish between feelings and sensations proper. For example, a feeling of patriotism or even of fear or anger would never be confused with a sensation. It is only when we come to the lower feelings or those which are largely physical that they can scarcely be distinguished from sensations. But certain selected examples will probably bring out a distinction which may be appreciated. Suppose we listen to a saw being filed, or that we draw a rusty nail through our teeth, or touch a slimy snake, or allow an insect to crawl over the skin. We experience the sensation of contact, but over and above and distinct from the sensation is a *feeling* of disagreeableness. This something is more than *knowledge giving*, it is *affective*, it is repugnant. I look at a beautiful picture, or witness a noble deed, and I experience a something not merely knowledge giving or intellectual, I am pleased. This affective state is a complex feeling, really an emotion, which is later defined.

Professor Titchener has given us one of the clearest discussions that we have of the distinction between feelings and sensations and which I venture to reproduce. He writes: "Let us introspect a true feeling, say, the feeling of drowsiness—and convince ourselves that it is made up of sensation and affection. Drowsiness begins, on the sensation side, with a sensation of pressure on the upper eyelids, with a tickling in the throat that leads to yawning and so brings a complex of muscular sensations, and with a sensation of pressure at the back of the neck (the head droops). The lids grow constantly heavier; breathing gets slower and deeper, so that its sensations change; the lower jaw becomes heavy, so that the mouth opens and the chin falls forward on the breast (pressure sensations); the neck sensations become stronger, the head heavier; and lastly the limbs grow heavy, and arrange themselves by their own weight. Sensations of temperature come from the surface of the skin, thrills of warmth running their course at different parts of limbs and trunk. Over all this mass of sensation is spread an affection; an easy, comfortable pleasantness. And the affection outweighs the sensation; we know better that we 'feel comfortable' than

that sensations are coming in from this or that organ. The total process then has all the marks of a true feeling." [1]

In each of the cases the feeling seems to be a physical process, though of course mental. These states seem altogether different from those represented by the expressions "I remember," "I know," "I judge," or "I comprehend." All comparatively simple affective states seem closely associated with physical processes. They also seem quite definitely localizable. But when I say I remember, I do not localize it; in fact I dissociate it from my body. The same is true of the states represented by the expressions, "I feel sad," "I feel remorse," "I feel hatred," "I feel pity," etc. For the simple, elementary, affective states we will reserve the name *feelings*, and to the more complex and seemingly "more mental" ones we will apply the term *emotions*.

Meaning of Emotion.—An emotion is the complex, agreeable or painful side of any mental state. This correctly implies that emotions are not different in kind from feelings, but merely different in degree. As sense feelings are concomitants of sensations and simple perceptions, likewise emotions arise in connection with higher and more complex intellection. Mere sensations or perceptions, such as looking at colors or symbols or being cut by a knife, cannot arouse concomitant emotions. They may arouse feelings of pain. When we apperceive the import of symbols which convey some associational knowledge, such as a telegram might bring, we may be aroused to the deepest emotion of grief or the highest ecstasy of joy. A good dinner, warm clothing, a good fire, produce sensations and pleasurable bodily feelings, but in themselves they cannot arouse emotions. They may suggest higher thoughts and these in turn may be accompanied by emotions. Titchener has expressed these relations in a very convenient formula, which I shall slightly modify:[2]

$$\text{Sensations} : \text{Feelings} :: \left\{ \begin{array}{l} \text{Complex} \\ \text{Intellectual} \\ \text{States} \end{array} \right\} : \text{Emotions}$$

[1] *A Primer of Psychology*, p. 61.

[2] *Op. cit.*, p. 141.

It should not be understood that there is an absolute line of demarcation between feelings and emotions. Sense feelings doubtless enter into the most highly developed emotions much more than we are aware of. The qualitative genetic relation is all that is intended in the equation. This relationship is full of pedagogical significance. Only a well-developed intellect can experience profound emotions. Sometimes there are outward manifestations of deep emotions, *e. g.*, love, fidelity, or religious emotion, in persons of low intelligence, but they are not real. Instead of being the accompaniment of profound conviction deliberately arrived at, they are largely imitative outward expressions and often belong to egoistic sense feelings.

Bodily Accompaniments of Feelings and Emotions.—The emotions when of sufficient intensity are accompanied by certain bodily changes. There is usually some facial expression indicating the character of the emotion. The whole bodily attitude also usually lends itself to the expression of the emotions if they are intense. Facial expression and bodily postures are such infallible indexes of the state of feeling that we can even determine in many animals whether the emotion is anger or pleasure. The flashing eye, knotted forehead, contracted eyebrows, and curling lip are absolutely indicative of anger, while the opposite conditions betoken pleasure. So close is the relationship that Darwin wrote a volume on the physical expression of the emotions.

We also have evidence of emotions in the condition of the pulse. In general pleasure quickens, while sorrow retards the circulation. Blushing and pallor indicate circulatory conditions and betray the state of the emotions. A change of circulation modifies the respiration and thus we have an added datum in detecting emotional states. In joy the breathing is deepened; when sorrowing the respiration is weakened and usually shorter. We are undoubtedly stronger during pleasurable emotions than when depressed. Under pleasurable excitement we are also said to be larger or to "expand," while when displeased we "shrink into ourselves" because the blood is withdrawn to the internal organs.

Not only is the affected circulation evidenced by blushing or pallor, but an examination of the heart reveals that its beats are often greatly changed in intensity as well as in rapidity. The beats of a "cold heart" are slow and quiet, while in a "warm heart" they are the opposite. It is no fiction to speak of a heart broken by grief. Sudden joy may sometimes produce similar results. In either case nervous conditions producing syncope are brought about. Palpitation, or rapidity of beat with low intensity, is often a result of strong or sudden emotion. So closely related to the most striking psychical states is the condition of the heart, that it is not difficult to understand how it has come to be spoken of as the seat of the emotions. Sympathetically through the nervous action the entire system may be disturbed. All know that sorrow, fear, or even joy may produce a flow of tears, that fear and other emotions may induce sudden perspiration, that fear may produce clamminess, or even paralysis, etc.

The Lange-James Theory of the Emotions.—That a change of emotional tone might be produced by receiving good or bad news every one would readily grant. That there might also be produced pallor or blushing, trembling or rigidity of muscles, heat or clamminess, quickened respiration, visceral disturbances, etc., no one would question. That is, every one recognizes the interrelation of intellectual processes, affective tones, and bodily changes. But suppose we raise the question as to the order of genesis of the three states we shall not find unanimity of opinion. It is a matter of common remark that the one who is bound down by grief is pale, often emaciated, and anæmic. The sequence in which these states follow each other is thought to be very direct and simple. "Of course," the popular mind says, "we gain a piece of sad news, we are sorry, and then we become depressed, pale, and anæmic."

Professor James explains the interpretation made by the uncritical mind in the following: "Common sense says, we lose our fortune, are sorry and weep; we meet a bear, are frightened and run; we are insulted by a rival, are angry and strike."

That is, "common sense" asserts that the sequence is as follows: (1) The knowledge-giving state. (2) The emotion. (3) The changes of bodily condition. Not so, however, say Lange and James. According to their view the order is: (1) The knowledge-giving state. (2) The changes of bodily condition. (3) The emotion. Or as Ribot states the case: "First an intellectual state, then organic and motor disturbance, and then the consciousness of these disturbances, which is the psychic state we call emotion." [1]

James maintains in his theory that "*the bodily changes follow directly the perception of the exciting fact, and that our feeling of the same changes as they occur is the emotion.*" He believes it is rational to say "that we feel sorry because we cry, angry because we strike, afraid because we tremble, and not that we cry, strike, or tremble, because we are sorry, angry, or fearful, as the case may be. Without the bodily states following on the perception, the latter would be purely cognitive in form, pale, colorless, destitute of emotional warmth. We might then see the bear, and judge it best to run, receive the insult and deem it right to strike, but we should not actually *feel* afraid or angry." [2]

The Lange-James Theory Considered.—It may be objected that were the theory correct then the assumption of the attitudes ordinarily taken in a given emotion would produce the emotion itself. To illustrate, an actor going through the representation of an emotion would feel the emotion itself. In case of the portrayal of anger, revenge, the emotions of the villain, etc., this might entail disastrous results because of the reflex effects upon the actor. In case of the portrayal of love it might, to say the least, often become embarrassing. The testimony of actors varies. Some corroborate the theory by asserting that they can not play a part properly until they have entered completely into the emotions portrayed. They say that until one lives his part he cannot successfully act it. Miss Isabel Bateman says: "I often turn pale in scenes of terror and great excitement. I have

[1] *The Psychology of the Emotions*, p. 95.
[2] *Principles of Psychology*, II, p. 449.

been told this many times, and I can feel myself getting very cold and shivering and pale in thrilling situations." "When I am playing rage or terror," writes Mr. Lionel Brough, "I believe I do turn pale. My mouth gets dry, my tongue cleaves to my palate. In Bob Acres, for instance (in the last act), I have to continually moisten my mouth, or I shall become inarticulate. I have to 'swallow the lump,' as I call it." [1] Even in cases where the actor plays a part and does not feel the emotion strongly, it is probable that it is felt to some extent. From my own experience I cannot conceive it otherwise. When the emotion is not felt strongly it is probably because there is such a difference between belief and make-believe. That is, in acting the intellectual state of belief is not really experienced. Were this factor experienced, unquestionably the other accompaniments would result. Could one be deluded into belief that the insult, the necessity for revenge, and the other stage acts were real then the concomitant bodily actions would be in evidence. Such conditions are actually produced in hypnotism. As before pointed out, belief that they are being burned causes the subjects to feel the pain. Belief that they will suffer no pain in having teeth extracted removes all painful feelings. Such belief is seldom experienced by the actor or by one mimicking the expression of some emotion. If the hypnotized subject is placed in any attitude as of prayer or anger the corresponding emotion is produced.

It is the series of visceral organic changes which Lange and James contend is the precursor of the emotion. Though the outward expressions are intimately related with the emotion the attitudes assumed in given emotions are somewhat continual and all have become modified through long volitional control. Grinding the teeth, though the primitive reaction in anger, is not the unfailing accompaniment of anger in a well-educated man. His anger may result in a letter, a speech, judicial action, etc. But the visceral accompaniments largely beyond the control of the will, such as circulation, respiration, temperature, or

[1] James, *op. cit.*, II, 464.

the change in secretions, are much more absolutely certain accompaniments of a genuine emotion. James writes on this point: "The *visceral and organic* part of the expression can be suppressed in some men, but not in others, and on this it is probable that the chief part of the felt emotion depends. Coquelin and the other actors who are inwardly cold are probably able to effect the dissociation in a complete way."

It is quite possible that a part of the actor's work is to learn to express what he does not feel. But it is doubtless also true that an actor can play certain rôles much better than others simply because there is consonance between his temperament and the part assigned. In fact, many claim that until he does live the part he cannot play it. Stanley has shown how completely we may gain control over the expression of emotions. He writes:[1] "When the will attains control over expression we may not merely repress the impulse to expression when we feel strongly, but having no feeling of a given kind, we may voluntarily adopt its expression, and this adoption of the expression very often leads by association to the real feeling. Again, when experiencing a feeling we may simulate the expression of another or even opposite feeling. It is often advantageous in the struggle for existence to throw others off their guard by deceiving them as to the real emotional state; hence, craft and guile have from a tolerably early stage in evolution played a part in the history of life." Even animals low in the scale of life learn to practise certain deceits. Animals' play often reveals this shamming aspect. They frequently tease and scare each other, expressing one state and evidently feeling another. Children delight in similar antics and tricks. Doubtless the drama itself owes much of its origin to this desire to masquerade which the child in recapitulating race development so instinctively learns to practise in his play. But to grant this does not mean a capitulation of the former view. It still remains true that the greater the harmony between the ideal and the actor, the more perfect the art.

[1] *Evolutionary Psychology of Feeling*, p. 363.

It takes no acute psychological observation to note that an emotion once initiated is greatly increased by giving way to the outward manifestations of it. To bow one's head when already suffering grief lowers one's vitality and increases the grief. To be sure, nursing the grief through contemplating its cause is one source of its production, but undoubtedly the bowed head, the curved spine, the lowered eyelids, the drawn lips all are causes as well as effects. Who could feel any enthusiasm in giving the college yell when sitting down and with head bowed low in reverential attitude? At the foot-ball game one's excitement increases largely in proportion to the amount of noise and motion he makes. It is bad pedagogy to try to secure enthusiasm by restricting bodily movement. Soldiers hear the quick-step march, their pace quickens and their courage rises simultaneously. The influence of music in war is tremendous. Let the soldiers hear a funeral dirge. Their pace slackens and their spirits fall. "Every one knows how panic is increased by flight, and how the giving way to the symptoms of grief or anger increases those passions themselves. Each fit of sobbing makes the sorrow more acute, and calls forth another fit stronger still, until at last repose only ensues with lassitude and with the apparent exhaustion of the machinery. In rage, it is notorious how we 'work ourselves up' to a climax by repeated outbreaks of expression. Refuse to express a passion, and it dies. Count ten before venting your anger, and its occasion seems ridiculous. Whistling to keep up courage is no mere figure of speech. On the other hand, sit all day in a moping posture, sigh, and reply to everything with a dismal voice, and your melancholy lingers. There is no more valuable precept in moral education than this, as all who have experienced know: if we wish to conquer undesirable emotional tendencies in ourselves, we must assiduously, and in the first instance cold-bloodedly, go through the *outward movements* of those contrary dispositions which we prefer to cultivate. The reward of persistency will infallibly come, in the fading out of the sullenness or depression, and the advent of real cheerfulness and kindliness in their stead. Smooth the

brow, brighten the eye, contract the dorsal rather than the ventral aspect of the frame, and speak in a major key, pass the genial compliment, and your heart must be frigid indeed if it do not gradually thaw!" [1]

Although I do not subscribe to the Lange-James theory in its entirety, yet I recognize many facts which go to show that the various bodily conditions have a very marked influence upon the feelings. One with biliousness cannot easily feel in a happy mood. Our general attitude toward life is strongly colored by the state of our health. With sound bodies and good digestion all the world is apt to appear roseate. But a poor night's rest or an unusual ache is most sure to give it a most sombre tint. There is undoubtedly a very definite interrelation among the three states—knowledge, emotion, action. They are probably three inseparable phases of every complex psycho-physical state, and it is impossible for them to be entirely isolated. Sometimes one phase may preponderate, sometimes another. The exercise of any one undoubtedly influences each of the others. An exhaustive discussion of the theoretical aspects of the question will not be attempted in this connection. The reader who is interested may refer to James,[2] Lange,[3] or Ribot.[4] A few illustrations will, however, be adduced to show the exceedingly close interdependence between the emotions and the physical expressions. An attempt will also be made to indicate some of the many very important educational bearings.

We know that in play-acting when assuming a given character we tend to feel the emotional states acted. For this reason many believe it dangerous to assume the rôle of a rogue or a rascal. Taking the rôle of a noble character uplifts one and stirs lofty desires. Undoubtedly every one is moved emotionally by assuming an attitude of prayer or devotion. A boy whistles on going through a lonely place at night, and thereby feels less afraid. When he has been hurt by a school-fellow or worsted

[1] *Principles of Psychology*, II, p. 462. [2] *Op. cit.*
[3] *Ueber Gemüthsbewegungen*, Leipsic, 1887.
[4] *The Psychology of the Emotions.*

in an encounter, he laughs a bravado laugh though ready to cry, and thereby dispels the desire to cry and manages to feel courage, which was slipping away. We tell a crying child, "Dry your eyes and you'll feel better," rather than, "Feel better and then your tears will cease."

Educational Suggestions from the Lange-James Theory.—The educational bearings of this theory are manifold and far-reaching. Actions and states constantly repeated determine what one is. What one is he comes to believe in and the customary usually becomes pleasurable, at least in a negative way. Consequently it is good pedagogy to teach children, for example, to assume an attitude of cheerfulness, to sit up straight, to expand the lungs, to walk sprightly, to have a good laugh occasionally. It all reacts upon their moods. For a person to go bent over with his back humped up and his chest drawn in is sufficient reason for him to become low-spirited. Plenty of oxygen, sufficient muscular exercise, and good bodily postures and habits are not only conducive to but absolutely necessary to the maintenance of cheerfulness. The one who becomes anæmic and nerveless is the one who is irritable and cross. Many external conditions contribute not a little to one's emotional tone. The weather determines, more than we think, the trend of one's conduct. Poor lighting is often responsible for not only defective vision and bad headaches, but also for much peevishness. Because of the intimate relations existing between the feelings and the intellectual and volitional states it is important for the educator constantly to bear in mind the necessity of securing bodily comfort and emotional buoyancy. Heating, lighting, ventilation all have their effects. Proper seating is a feature too little considered. Cramped positions or dangling feet produce irritability to say nothing of bodily malformations. Recesses, alternation of work and play must also be considered in trying to secure desirable emotional attitudes.

Through imitation one unconsciously assumes the attitudes of those about him. Consequently imitation plays a most important part in the determination of the feelings. A light-

hearted person diffuses his feelings among all whom he meets. Similarly one who is low-spirited casts a spell of gloom over all his associates. Feelings are even more contagious than disease. Children are very quick to be inoculated with the moods affecting the teacher. On those days when children are bad-natured, fretful, or especially trying, the cause can usually be traced to some external influence—bad weather, an irritable teacher, improper lighting, insufficient nutrition, physical discomfort, etc.

One of the most potent means of promoting good tone is through song. This is largely true because song necessitates attitudes and expressions of cheerfulness. This means is not sufficiently utilized. Instead of having the children lift up their hearts and voices in sprightly song, and in simple melodies expressive of beautiful sentiments, the little children are often set to learning the *science of music!* Desirable as knowledge of the science of music may be at a later age, it has no place in a child's course of education. Song and poetry should be a means of emotional quickening, and this they cannot be if made a mere intellectual gymnastic. The science of music, the science of grammar, the science of rhetoric, should be deferred until long after the child's soul has *felt* the beauties of music and speech. His soul should have been stirred to its depth by the harmonies of tone, and the noblest of human sentiments awakened, long before he is able to analyze the formal means of expressing them. It is indeed pathetic to go into a school-room where the children are mechanically learning to name musical symbols, and in an equally mechanical way to ticket the parts of speech, when they have never been made to thrill with emotion through the singing of beautiful songs, or the hearing of literary masterpieces read by a skilful teacher. Upon every hand there is so much tendency to mechanization. In the attempt to reduce everything to system no teaching is deemed of worth that does not issue in an examinable product. We can examine a child to see if he can write the tonic *sol fa* scale, but who can tell whether a child stands 80 per cent. or 92 per cent. in his emotional striv-

ings? In our search for intellectual examination material we often starve the nobler emotions.

Relation Between Exercise and Feelings.—Pleasurable feeling is usually the accompaniment of the normal, moderate use of the body or of the mind. Excessive use produces over-stimulation. Pain or fatigue are the results which signal a cessation of exercise. The child who is given healthful bodily and mental exercises finds them pleasurable and exhilarating. No healthy child desires inactivity. He is continually moving about and making investigations. One who follows a healthy normal child about for a day or an hour will be ready to agree that overflowing energy and ceaseless activity are among his most prominent characteristics. Allowed to take their own pace and to flit about as curiosity prompts and interest sustains, normal, healthy children are happy and active from morning till night. If artificially pushed to excess in any one direction or not allowed diversity of occupation they lose pleasure, and become peevish and fretful. Thus we may formulate the law that pleasure is conditioned upon a normal activity along the lines of spontaneous activity, and upon a sufficient diversity to preclude monotony.

Inactivity except as a means of rest cannot produce pleasure. In any case it is negative rather than positive. The child obliged to sit absolutely still is a most unhappy child. To require a child to do so for long at a time is positively sinful. The schools must recognize this fundamental demand for healthful activity. The most quiet school may be the very worst managed. The children should not sit for very long periods, and not in unnatural positions. Mentally they must be provided with something to occupy their attention—not mere "busy work," but something that appeals and is worth while. How often the peevish child in the home can be emotionally transformed by simply helping him to find something to do! How many sins of omission can be charged up to the home because of ignorance of this relation between activity and happiness! Many boys and girls have gone to ruin, simply for lack of

something to do. "Satan finds some mischief still for idle hands to do," and "an idle brain is the devil's workshop."

Æsthetic Emotions are evidently very deep-seated, for we find that they are not at all peculiar to man. Romanes and Darwin claim that birds are the first in the scale of evolution to possess these affective states. They must be well developed, however, in birds, as many species of birds are very highly decorated and seem to take a pleasure in displaying and observing the decorations. Darwin says: "When we behold a male bird elaborately displaying his graceful plumes or splendid colors before the female, while other birds, not thus decorated, make no such display, it is impossible to doubt that she admires the beauty of her male partner." [1] He says that humming-birds and others decorate their nests, which shows that they must derive some kind of pleasure from it. The song of birds must also have been developed through preferences for certain æsthetic sounds. The standards, to be sure, would not all be approved by well-developed human standards. Is it not probable that even among fishes and reptiles color combinations have been more than merely protective, but that they have played a considerable rôle in sexual selection? The lowest savages manifest æsthetic emotions in their preferences for certain colors, sounds, and forms. To be sure, the standards would not frequently be selected by civilized people. But Darwin says in the foregoing connection, that "man and many of the lower animals are alike pleased by the same colors, graceful shading and forms, and the same sounds."

Music has its beginnings far back in race history. The sense of rhythm is observable in many lower animals. It is universal in man. The dance is rhythmical and is the first known art. Music was developed from the dance. Powell says: "Rhythm was born of the dance, melody was born of poetry, harmony was born of the drama, symphony was born of science." Because of this order of development we may gather a hint with reference to music teaching in the schools. Rhythmic bodily

[1] *The Descent of Man*, p. 104.

movements as in the dance and in various plays should precede systematic training in music as a science. Music as an art should precede. Simple folk-songs learned by ear should long precede the artificial note-singing of the school. Music should first of all be a language of emotion and not a feat of intellectual analysis and synthesis. Classical music is a product of science, an evolution of intelligence, and not alone a language of the emotions. Music should be taught in the schools for the purpose of developing good cheer, to inspire with beautiful sentiments, to uplift, and to harmonize the soul. The songs we all love most are not those termed "classic"; no, they are the simple melodies that anybody can sing, and the music is coupled with words which touch a responsive chord in every heart. One of the strongest ties that bind the German nation together today is the universal custom of singing the folk-songs and national airs. No home is so lowly but that all can join in the melodies and thus give expression to sentiments they feel, and which in turn are intensified. How often I have witnessed the German soldiers marching merrily at five o'clock in the morning to their *Exercirplatz* singing some of the inspiring national airs like *Die Wacht am Rhein!* Their work is hard, dull, and monotonous; subordinates are held in strictest subservience; their fare is of the coarsest; their boots of the heaviest; their comforts the most meagre; the prospects the most uninspiring (so all seemed to me), but under the influence of these songs, buoyancy of spirits was everywhere evinced, the heavy boots appeared to be easily lifted; their songs rang out in the still morning air with a clearness and tone of fidelity that carried me in imagination to the days of chivalry. Doubtless no other factor contributes so much to the love of home and fatherland as the songs which are constantly upon their lips. In this country we have not learned the value of song.

Intellectual Emotions.—By intellectual emotions we mean those emotional attitudes which are felt toward intellectual activity. For example, one may experience keen delight in working out one lesson and the greatest distaste in accomplishing another.

Different attitudes may be experienced toward the same task at different times and under different circumstances. These emotions have an instinctive basis and the earliest manifestation is in the form of curiosity. There are, of course, various gradations of curiosity. The first stage is that of surprise, which makes its appearance early in child-life. Preyer has noted it as early as the twenty-second week. There is perhaps little mentality connected with it, but the shock gives rise to physiological changes such as raising the eyebrows, opening wide the eyes, opening the mouth, and a change in the pulsation of the heart. Animals manifest many of the same signs.

A higher stage is that of wonder. In this there is a concentration of attention and reflection upon what is experienced. Dogs, horses, deer, monkeys, and other animals exhibit wonder in the presence of strange objects. If the wonder is strong it passes into inquisitiveness or interrogation, as Ribot calls it. There is then an attempt to solve the question. The dog on seeing a strange object smells it, walks around it, withdraws, ventures to touch it, withdraws again, and thus keeps up an investigation of his own sort until satisfied. I have seen a dog thus study a calf for a half-hour. Of course, there must be some marks of familiarity to excite wonder and curiosity. Totally unfamiliar objects do not draw the attention nor excite curiosity.

Surprise and astonishment are said by Sully and others to be akin to curiosity. It seems to me, however, that they have much more in common with fear, which is often a result of a stoppage of intellectual workings. The mind seems balked in a train of thought or it is suddenly awakened to a new kind of experience. Surprise and astonishment have little of the pleasurable element in them. On the contrary, it is the pain of arrest which makes them clearly allied to fear. Tracy mentions[1] cases of surprise being noticed as early as the end of the first week of life. One child then seemed to notice his own fingers attentively. This is rather precocious. "From this time onward, wonder is con-

[1] *Psychology of Childhood*, p. 49.

stantly manifested at pictures on the wall, sunbeams dancing on the floor, the fire crackling on the hearth, and especially at the movements of animate beings. The infant gazes long and steadily at these strange phenomena." Infants of a few weeks old stare around at every new phenomenon and every new face, often expressing fear at those things which are strange.

Preyer noted astonishment in his child in the twenty-second week. One of my own children on the thirteenth day started suddenly when she heard a chirping noise. She looked around apparently for the cause. By the twenty-fourth day she followed moving objects very definitely. At that age she watched a swinging rope with apparent interest for some time. A light was always looked at with great intensity. In the fifth month surprise on seeing a railway engine produced such a degree of surprise that it developed into shuddering fear. By the twelfth or the fourteenth week the child can sit up, if supported, and from this time and even before it begins to grasp objects and to handle them in a more definite way.

Real curiosity is early manifest and develops rapidly. Taine wrote: "Any one may observe that from the fifth or sixth month, children employ their whole time for two years or more in making physical experiments. No animal, not even the cat or the dog, makes this constant study of all bodies within its reach. All day long the child of whom I speak—twelve months old—touches, feels, turns about, lets drop, tastes, and experiments upon, everything she gets hold of, whatever it may be—ball, doll, coral, or plaything. When once it is sufficiently known, she throws it aside; it is no longer new; she has nothing further to learn from it, and so has no further interest in it." [1]

The little child is said to be mischievous when it overhauls work-baskets, pulls down books, gets into cupboards, tries doors, disarranges curtains, picks up pins, buttons, and dirt, but it is merely seeking new experiences. It tears, picks apart, and smashes not always to find out the mechanism or the philosophy of the contrivance, but rather to gain new experiences which

[1] *Mind*, II, p. 252.

are a source of interest. A child of five or six months of age will frequently drop an object scores of times, if the object is picked up each time, just to see what will happen. He strikes the cup on the table with a spoon, and he keeps it up until his senses seem satisfied. It is much the same with fire-crackers on a Fourth of July, a new whistle, a new drum, or a soldier-hat. The experience is continued as long as it gives pleasurable sense stimulation.

Still higher than this curiosity is the kind exhibited by children when they try to find out how things are made or how things are done. Different children are inquisitive in different directions. One is inquisitive about dolls, another about guns, another about carts and sleds, and others about machines, birds, plants or gardening. The inquisitiveness varies at different times in the same child: one day it is a toy, the next a journey, and the next the Christmas holidays. There is no constancy of inquiry such as is exhibited by the scientist. The direction of the child's curiosity is determined by chance circumstances, environment, and direction, as well as by natural tastes.

In childish curiosity we have the germ of future scientific study. Through curiosity the child spies the bird's nest and perhaps pokes it, but in so doing learns some things he did not know before. He is curious to know how things came to be and what will become of them. He wishes to know the use of all sorts of things and is continually asking questions, the answers to which he may not understand. I have been asked by children of five why there was moss on one side of the trees, why the moon kept moving at the same rate as we did, which came first the hen or the egg, what makes the rain in the clouds, and thousands of other questions that only the teacher is ever supposed to ask. Now in these questions are golden opportunities. The child's curiosity should be satisfied and stimulated. He should be answered in such a way as to give the knowledge and also to start other questions. But does this accord with the usual practice in the home and in the schoolroom? Far too frequently the child is silenced by rebukes

given as answers. Relatively seldom is he answered in such a way as to show him that many answers can be wrought out for himself. At best the information is dogmatic in nature, frequently grudgingly imparted, and seldom provocative of thought. At school the child is often systematically taught to consider only dogmatic statements. He learns perfunctorily what is assigned him and repeats parrot-fashion when he must recite. The lesson period instead of inviting questions, represses them, and the child gradually learns to conceal his ignorance as much as possible. This sometimes comes to be an unwritten law even among high-school and university students, and the inquisitive one is repressed by the teacher and by the public opinion of his fellows. Even among students in higher institutions there are too few who are sufficiently independent in thought. They are too often satisfied to take down in their note-books whatever is dictated and then deem their duty performed if they can re-echo enough to secure a passing grade upon it. Instead of independent opinions they are taught, through the methods pursued, to gain the words, the garments in which others' opinions are clothed. Like all borrowed clothing, such knowledge exhibits monstrous misfits. This is a sad commentary on too many schools. Education should increase curiosity until it becomes scientific investigation rather than stifle it and produce scientific dumbness. Ideally the pupil should be the principal questioner and the teacher should be ready to lead to the answer. The teacher's questions should be given largely to lead the learner to ask questions for himself. When the student has arrived at that point in his career when he can interrogate properly and persistently he is no longer in need of teachers. But how many teachers regard their office differently! To fill up the mind with certain traditional square yards of arithmetic, geography, and history means education to them. Oftentimes it produces little higher educational effect than that exhibited by the parrot. There is no inquisitiveness, no initiative, no independence of thought. I often think that it is mainly through their non-school experiences that students have gained any

independence of thought at all. So much of their school work has been like prescriptions, blindly followed, as a servant does a cook-book. In most matters better an erroneous idea if independent than the correct one that is merely the hollow echo of an opinion taken uncritically from another. The one who is critical but in error will correct his errors, but the echoist is ever in dire danger of repeating the errors received through absorption.

Sympathy means a condition in which one enters into the feelings of another, sharing the pleasures or pains. It is an emotion of rather late appearance. Although we are told that it exists among the lower animals, it is there of a very low order. Except as a manifestation of maternal instinct in the animals we find little indication of it. Most animals leave wounded or disabled comrades to their hard fate. Romanes believes that sympathy is first seen among the hymenoptera. He places its first appearance in the child at about five months. Sigismund records that he noticed sympathy at the end of three months. Sully and Tiedemann believe that they have noticed it as early as the end of the second month. But these instances are all cases of imitation and have very little of genuine sympathy in them. One child will cry when another cries or sometimes when it hears music, but it is questionable how far the feelings are shared, and still more questionable whether there is a desire to enter into the other's feelings, which is often true in higher stages of sympathy. At two years and ten months of age my boy was looking at a picture of a boy crying, and said, "Boy haint got no mudder." I answered, "No, the boy has no mother," thinking merely to coincide with his expression. He repeated the same thing again, and burst into tears and sobbed bitterly. I cannot think it was a deeper feeling than mere contagion from the appearance of the crying child, for he had absolutely no idea of the import of what he said. He knew nothing of death or the meaning of bereavement.

To really sympathize one must put himself in another's place. This often requires imagination of the other's states. To

imagine anything one must have had a previous experience of that thing. One must at least understand the conditions producing the affective states of another in order to sympathize with them. Circumscribed experiences often make it impossible for an individual to have broad sympathies. There is nothing that gives one such powers for usefulness as breadth and variety of sympathies. No person in public relations can hope to succeed in drawing the masses to him unless he can go out to meet them in sympathy. To sympathize with them means that he must understand their point of view. The great man, who like Lincoln, can perform some act which all the masses can understand and appreciate is the one who can gain their sympathies. They understand the simple, homely, every-day acts and therefore their sympathies are enlisted. The more philosophic acts of statesmanship are not understood, but through the commonplace acts, faith is engendered. The great statesman who has only this philosophic side, and who can never come to the people's level will never raise the people to his level. In thinking of Queen Victoria all else is forgotten about her by the multitude, except that she was a tender mother, a devoted wife, and a dutiful daughter. Because of these characteristics she will go down through all the ages beloved by the masses.

The teacher who cannot meet pupils on their own level, though he may be ever so scholarly, wise, and philosophically just, will never enlist their sympathies. Many teachers have either forgotten childhood or else they never had a real childhood, for the pupil's actions are no longer comprehensible to them. They do not and probably cannot sympathize with child life. Such teachers should either cultivate an intelligent acquaintance with child-life so as to understand and appreciate it, or quit the business of teaching. It is lamentable that in the teachers' preparation the main emphasis has been placed upon the understanding of subject-matter and so little to developing a deeper and more sympathetic understanding of child-life.

It is highly important that pupils be in sympathy with the school and its functions. This is often, too often, not secured.

Pupils feel that the teacher is an autocrat dictating laws without reference to the wishes or even welfare of the children themselves. Few openly rebel though many secretly long for freedom. Such need not be the case if pupils are only led to see the meaning of school rules and regulations and if they have developed a feeling of personal ownership in the school. Though I have no patience with the artificial schemes of self-government, so called, in which the teacher abandons all rights, privileges, and authority, yet pupil co-operation must be secured. This can only come about through their understanding of the aims, purposes, and means of government. They should participate and co-operate to the fullest extent possible, but, what is equally as important, they should understand that their immaturity and their inexperience place limitations upon their powers of governing wisely and hence the necessity of acquiescing in those means employed by teachers, and school boards. They should be led to see that the school is theirs and that whatever affects the individual affects the school, also that whatever affects the school in turn affects the pupils in the school. As soon as a correct understanding is gained a sense of participation results. As soon as a sense of participation is developed the feeling of sympathy begins to grow.

From the stand-point of social needs it is greatly to be desired that children become sympathetic with the various forms of political and social organizations. This can only be accomplished by obeying the laws of the development of sympathy, *viz.*, by giving a thorough knowledge of those things with which the children ought to sympathize. The classes of people who are out of sympathy with institutions are the ones who do not understand them. Being in sympathy with our institutions does not mean being satisfied with everything, but it does mean intelligent appreciation of the conditions under which they have been developing and are developing, and also patience with the slow pace of development. It should also reveal definitely that social development depends upon the active co-operation of all the individuals composing society. The doctrine of help-

ful service needs much emphasis in our homes, schools, and churches.

Fear is an emotion that is manifested early in life. Among lower animals there are none that do not exhibit some sort of fear. Since each class of animals seems to manifest particular kinds of fear, these are probably instinctive. The young of all animals are probably without fear immediately after birth, but the instincts of fear are simply deferred and very soon begin to function. That fears are instinctive, however, is shown by the fact that animals give evidence of fear without any experience and without any possibility of imitation. For example, young kittens show fear of dogs. Sometimes a different early environment will develop new tendencies so that those which would have developed may never become manifest. Mr. Spalding cites illustrations of this in chicks. Those hatched in incubators and which see men early are never afraid of them. But if they do not see them when very young they later exhibit great terror. He kept three chickens hooded until they were about four days old and then when unhooded their behavior was as follows:

"Each of them on being unhooded, evinced the greatest terror of me, dashing off in the opposite direction whenever I sought to approach it. The table on which they were unhooded stood before a window, and each in its turn beat against the window like a wild bird. One of them darted behind some books, and, squeezing itself into a corner, remained cowering for a length of time. We might guess at the meaning of this strange and exceptional wildness; but the odd fact is enough for my present purpose. Whatever might have been the meaning of this marked change in their mental constitution—had they been unhooded on the previous day they would have run to me instead of from me—it could not have been the effect of experience; it must have resulted wholly from changes in their own organization." [1] Spalding tells us that young chicks become terrified at the first appearance of a hawk, but that the appearance of a dove creates

[1] *Macmillan's Magazine*, February, 1873, p. 289.

no fear. Ribot states,[1] on the authority of Gratiolet, that a little dog which had never seen a wolf was seized with indescribable terror on smelling a piece of wolf-skin. Tracy[2] classes as hereditary those fears manifested by the child at a few weeks of age when it starts and cries at any sudden sound or strange sight. Many children cry on seeing dogs or other animals, or when it thunders. They frequently shrink back in terror when they see a person in black or when they hear a strange voice. "A little girl, slightly over two months old, appeared terrified on beholding a distorted face; she cried out, and sought protection in her mother's arms. It was long before she was restored to her accustomed tranquillity—the vision reappeared in memory, haunted her fancy, and brought tears to her eyes."

In his pioneer work on fear, Hall gives a wonderful array of evidence concerning the instinctive basis of fear. He says: "In the past the pain field has been incalculably larger than the pleasure field, and so potent is this past that its influence dominates the most guarded child, in whom otherwise the pleasure field should be relatively the largest anywhere to be found. Now, darkness and the unknown alike have few terrors; once they had little else. The old night of ignorance, mother of fears, still rules our nerves and pulses in the dark despite our better knowledge. Lacking this latter, children fall still more abjectly under her spell. Hence it is that animals found only in distant lands or long extinct, robbers, impossible monsters, ghosts, etc., rarely present, and never feared in waking consciousness, bear witness again to the remoteness of the past to which some of the roots of this class of fears penetrate." Further, "The more I study the feeling of children for animals, the less I can agree with Sully, Compayré and others that the hypothesis of ancestral transmission is not needed here. More than many others, these fears [of animals] seem like lapsed reflexes, fragments and relics of psychic states and acts which are now rarely seen in all their former vigor, and which the indi-

[1] *Psychology of the Emotions*, p. 210.
[2] *Psychology of Childhood*, p. 44.

vidual life of the child nor even present conditions can wholly explain." [1]

Although fear is often shown in the presence of some absolutely new experience, we are hardly justified in concluding that there is a definite instinctive fear of the particular object which has excited the emotion. As previously shown, many instincts, especially of mankind, are very vague and susceptible of development in many directions. Hence, it is more to be supposed that a great variety of objects may produce fear. These experiences which come suddenly, without warning, which are violent, and which cannot be understood, are the ones likely to produce fear. That a cat is suddenly thrown into a paroxysm of fear on the first appearance of a dog, while a child might not be, can possibly be explained by the fact that the cat experiences a strange and sudden sensation of smell. Because of the dulness of the sense of smell in the child it receives no sudden and alarming sensation. The cat is afraid not because it is a dog, but because it has been violently disturbed. It would undoubtedly have been alarmed at the appearance of a kangaroo, though it has no racial memory of kangaroos. I believe, however, that there are hereditary predispositions to feel fear.

Since there are such strange hereditary tendencies to experience fear it is important that all causes which would produce violent shocks should be guarded against. This is especially important in the years of infancy. It is during these plastic years that the formative tendencies of life are produced. The infant in the cradle should be safeguarded from sudden and loud noises, strange sights, and disagreeable tactile experiences. A child with frequently shocked sensibilities comes early to dread every new and strange experience, while the one without remembrances of former disagreeable shocks grows to expect only pleasant experiences. The former may have latent fears stimulated and new ones implanted, while the latter will be fortified against undesirable potentialities and protected against the germs of new ones.

[1] *American Journal of Psychology*, 8 : 189, 209.

When the child becomes older and fears are implanted through higher mental processes the same careful treatment should be continued. The child then begins to fear through imagining harmful consequences that would come from certain objects or from certain actions which he is led to believe would be harmful. The telling of sensational stories is one of the most frequent causes of fear in children. Injudicious servants, playmates, and even parents and teachers frequently tell children of goblins, ghosts, and bogies, sometimes just to interest children, but even more often to scare them. The children are not seldom frightened into obedience by threats of being taken by the bogey man or the bears. Soon all dark and unexplored places are through imagination peopled with frightful creatures. The child comes to dread a new situation and becomes timid and hesitant in undertaking new things. If the child is neurotic in addition to this psychical condition, he is easily made a coward. Bashful children injudiciously treated are frequently made to suffer untold agonies through imagining ridicule or censure.

A bashfully inclined child, by being repressed and made to fear being observed, and through imagination of unfavorable comment, can be made a life-long social coward. When we are thinking of making Young America "mind" or "to be seen and not heard," we should take a second thought as to whether we may not be repressing the very boldness which will make for social and moral courage in manhood and womanhood. Better smile at a little over-confidence or put up with egotism which smacks of impudence than repress every manly and womanly instinct of courage. There are doubtless thousands of weak-willed, shame-faced, limp-spined men in the world who owe their condition to fears engendered by overstrict and injudicious parents. In order to have made them valiant and courageous there would have been necessary only a little protection from foolish fears and a stimulating encouragement to have confidence in their own powers. To be continually told that one will fail in an undertaking is with the naturally timid almost fatal to success. It is often unfortunate to have children in the school

obtrusive in their boldness, but it is probably more unfortunate to have the child utterly distrustful of his own powers. Life is so full of real disappointments that no one needs to be harassed with fears of any unnecessarily imagined ones. Self-confidence is one of the greatest factors in success.

The results of the use or the abuse of fear may be suggested in the following:

Timidity			Caution
Cowardice			Prudence
Bashfulness	<——< FEAR	>——>	Foresight
Self-consciousness	(Negative)	(Positive)	Fear of wrong

It will thus be seen at a glance that to educate the child so that he shall learn to fear wisely and effectively is a very important part of education. The lowest form of fear is instinctive and directed toward self-preservation. Of the highest we may voice the proverb that "The fear of the Lord is the beginning of wisdom." Marden says: "Doubt, uncertainty, fear of failure, are the greatest enemies of mankind. No man ever yet accomplished a great deed with a doubt clouding his mind. The miracles of civilization have been performed by men and women who believed in themselves. In spite of ridicule, incredulity, and abuse they maintained unwavering faith in their power to accomplish the tasks to which they had set themselves."

The following good suggestions are in entire harmony with the teachings of the Lange-James theory of the emotions: "'Assume a virtue if you have it not,' is sound advice. There is a great deal in assuming the part or character you desire to play in life's drama. If you wish to take the part of a successful man you must assume the mental attitude, the outward manner of one. It is not difficult to pick out a successful man in the street. If he is a leader, a man who relies upon himself, every step, every movement indicates it. There is assurance in his very bearing. He walks as if he were master of himself, as though he believed in his ability to do things, to bring about results. People are impressed in spite of themselves by a con-

fident bearing. They trust a man who believes in himself; they take his ability for granted, but they have only pity or contempt for the self-depreciating doubter. The man without self-confidence and iron will is the plaything of chance, the puppet of his environment, the slave of circumstances. With these he is king, ever master of the situation." [1]

Ella Wheeler Wilcox has beautifully expressed the idea in the following:

> "'Twixt what thou art and what thou would'st be, let
> No 'if' arise on which to lay the blame.
> Man makes a mountain of that puny word,
> But like a blade of grass before the scythe,
> It falls and withers when a human will
> Stirred by creative force, sweeps toward its aim."

Anger is an emotion which is displayed early in the child's life. Darwin believes that real anger is displayed as early as the fourth month. Perez cites a case of apparent anger caused by jealousy which occurred at three and one-half months. It is difficult, however, to distinguish clearly in very young children between expressions of anger, fright, or pain. The cries, facial expressions, and bodily contortions are very similar in all. The emotion doubtless has an instinctive basis. It is made manifest in reaction to a sense of pain or injury. The physical expressions accompanying the emotions are too well known to need more than mention here. There are characteristic expressions even among animals. Spencer says: "The destructive passion is shown in a general tension of the muscular system, in gnashing of teeth and protrusion of the claws, in dilated eyes and nostrils, in growls; and these are weaker forms of the actions that accompany the killing of prey. . . . What we call the natural language of anger is due to a partial contraction of those muscles which actual combat would call into play; and all marks of irritation, down to that passing shade over the brow which accompanies slight annoyance, are incipient stages of the same contractions." [2] It is claimed that the various human emotional expressions like

[1] Chicago *Record-Herald*.

[2] *Psychology*, § 213.

clenching the teeth, curling the lip, etc., are genetically traceable to more primitive ancestry. Clenching the teeth and probably curling the lip are connected with the act of biting. Other characteristic expressions are supposed to be connected with actions of attack or defence.

It is unnecessary in this book to discuss the manner in which outbursts of angry temper should be curbed in children. Unless the passions are restrained it is very easy for the child to fall into the habit of flying into a rage every time his wishes are thwarted. Such a habit will be a source of great weakness in later life and will operate against success at many a turn. The individual who goes into a blustering rage is a weak opponent for the man who keeps his head. In argument or in physical contests the angry man dissipates his energy and becomes an impotent antagonist. The poet says of him:

> "He swells with wrath; he makes outrageous moan:
> He frets, he fumes, he stares, he stamps the ground."

The child should early be led to see that uncontrolled temper will lead him continually into trouble and into doing things which may prove sources of life-long regret. As Edmund Spenser wrote:

> "Full many mischiefs follow cruel wrath,
> Abhorred bloodshed, and tumultuous strife,
> Unmanly murder, and unthrifty scathe,
> Bitter despite, with rancor's rusty knife,
> And fretting grief—the enemy of life."

Though we must condemn unrestrained angry passions, yet there are occasions when with Lear we should say:

> "Fool me not so much
> To bear it tamely; touch me with noble anger."

The child should early be led to look with indignation upon that which is base, unjust, and unworthy. He should be trained to look with disgust and abhorrence upon conduct that is disgraceful not only where personal injury has come to him but whenever justice and right have been outraged. Children must be aroused

out of indifference to wrongs witnessed against others, into active championship of the oppressed and the down-trodden. The habit cannot be formed too early. There is something wrong with the education of children of ten years of age if they delight in the persecution of animals, in seeing weak children bullied and abused by the stronger. Often children tease others in a thoughtless way, but no well-trained child delights in witnessing or causing real injury to another. Abraham Lincoln, in manhood the emancipator of the lowly slave, in boyhood was laughed at as the friend and champion of the poor inoffensive turtles which were stoned by the rude school-boys. He was as ready to fight for the rights of the turtle as for the oppressed black man. Though teasing and bullying are instinctive in childhood and youth, I am not ready to admit that they cannot be and should not be well under control in the ordinary child before he is ten years of age.

It is only through the development of the feeling of indignation against injustice that one becomes the real friend of society. To not injure others is well, but not enough; it is only negative. One must be positive as well as negative. Proper development of this feeling leads one to defend his friends and neighbors, his state and his country as well as himself. It leads one country to defend another unjustly attacked. It led the United States to defend Cuba and the Philippines against an outrageous foe. It led the Union to dismemberment when each section believed itself to be the champion of certain inalienable rights apparently violated. These feelings must actuate the philanthropist, the minister, and the true statesman. The feeling is apt to be ill-nourished, because personal loss often follows attempts to champion the rights of society. Were the feeling properly developed in all, our cities would be well governed, our streets clean and well-lighted, public sanitation perfect, our children properly schooled, our laws better obeyed, justice better administered, our taxes cut in half, our public parks increased, public nuisances abated, the poverty-stricken provided with work, municipal corruption eliminated, etc. But so long as the public conscience

is apathetic and we do not feel indignant at public wrongs unless we are affected individually, just so long will public wrong continue. We are too apt to close our eyes to everything that does not strike home. The criminal knows this. Only the individuals wronged are anxious to testify against the criminal and they are easily eluded. But when every individual in a community is ready to champion the rights of every other individual in the community then the criminal finds it dangerous to operate there. We need a multitude of men such as one of our great cities recently furnished us in the person of a young lawyer, who tracked to their hiding places and brought to the bar of justice a whole ring of corrupt city officials. So unselfish was he that he rejected the offer of the grateful city of a house and lot as a recognition of his meritorious altruism. His services had been only in the cause of right and as an indignant rebuke against the evils which the city suffered. It was only such service as every ideal citizen ought to be willing to render.

The child should also be taught to stand up for his personal rights. To be sure, he must learn not to assume those which do not belong to him. But he must learn to know his rights and to maintain them. This means that he must not allow others to impose upon him or to bully him. We applaud the nation which fights the foe that insults her colors and why not the individuals that maintain their personal dignity? The boy or girl who is habitually teased and bullied is usually one with cowardly traits. The one who is cowardly in defence of himself will seldom exhibit courage in protecting the rights of others. Every one should have self-respect and should maintain it. Righteous indignation is not only permissible but commendable whenever injustice has been witnessed, whether the offense is against one's self or against society.

General Principles in the Education of the Emotions.—The main principle underlying the education of the emotions is that we are to seek their control, rather than their repression or their undue growth. There are no emotions that are *per se* wholly undesirable, but they may need much stimulation in order that

they may develop in desirable directions. All need the refining effect of breadth of knowledge to make them pure and exalted. In fact the higher emotions are the product of knowledge which has come through apperception to possess a given feeling-tone. For example, love of country or of home; what are they but certain states of feeling developed through knowledge? The one whose knowledge of home and country is limited to those of the tribe has not much real affection for either. Only the civilized person with a wealth of meaning gained through knowledge of these institutions can have much real love for them.

The highest phases of love are unknown to children and savages. The dog is fond of his master, but knows no love. The child is fond of those who protect and care for it, but his love is not deep nor abiding. His affections are easily gained. A bit of candy, a bright colored toy and he is your worshipper, *i. e.*, until you are out of sight and then his affections are as easily transferred. How many times a day are the child's affections transferred from one playmate to another! One minute he is friend and admirer, the next, enemy and contemner. Even among children in the grammar grades the rings and cliques are as unstable as ice on a summer's day. One day two girls are chums, thick as possible, and the next they will not speak to each other. It has been observed that it is impossible to secure team work in base-ball and foot-ball among boys under twelve or fourteen. The child's grief is soon over. Even after the loss of a parent, the grief is seldom deep or lasting. Others can immediately gain the place of the lost one. This all means that genuine love in its highest phases is impossible without highly trained intellect. The adult who knows the worth of the loved one, who understands the far-reaching consequences to one's own life, is the one who feels grief at separation.

Shakespeare says of youthful love:

> "What is love? 'Tis not hereafter;
> Present mirth has present laughter;
> What's to come is still unsure.
> . . . Youth's a stuff will not endure."

Hence in attempting to cultivate the higher emotional nature we must bear in mind the functional relation of affective processes to intelligence. The development of the higher emotions is absolutely dependent upon intellectual expansion. They are a result of rationalization.

CHAPTER XXVI

INTEREST AND EDUCATION

Nature of Interest.—Interest is an attitude of the mind which impels it toward the object of its contemplation. The impulse is experienced because of a feeling of the worth of the object or action contemplated. Interest is usually a pleasurable state of mind, but it may sometimes be a painful state. In either case it is fascinating and compelling. One who is thoroughly interested in anything has his whole mind actively concerned with it. Whenever freed from other things the mind normally reverts to the object of its deepest interest. Dewey says: "The root idea of the term seems to be that of being engaged, engrossed, or entirely taken up with some activity because of its recognized worth. The etymology of the term *interesse*, to be between, points in the same direction." [1] Interest may be of varying degrees and kinds, from pleasure in cutting colored papers, or curiosity concerning geological specimens, to intense love for another person or love for a divine being. As before noted, the interest may be a painful attitude. The type discussed in this chapter, however, will be pleasurable states.

In addition to being an emotional state, interest is very closely related to the intellect on the one side and to volition on the other. From the definition it will be seen that all interest has an "active or propulsive phase." There is always an accompaniment of self-expression, an active attempt by the individual at the identification of the self and the object of its interest. This can, however, only be the outcome of knowledge. To be concrete, if I am interested in a thing I attempt to make it my pos-

[1] *Interest in Relation to Training of the Will*, p. 13, Second Supplement to the First Yearbook of the National Herbart Society.

session, or I try to make the thing, or I attempt to accomplish the line of action, doing, making, understanding, possessing, etc. Interest makes the mind kinetic, while knowledge gaining without interest is a static condition. Things which interest us are voluntarily and purposely attended to and without external compulsion. A majority of the stimulations of the senses never receive attention largely because they have no interest for us. James says: "Millions of items of the outward order are present to my senses which never properly enter into my experience. Why? Because they have no *interest* for me. *My experience is what I agree to attend to.* Only those items which I *notice* shape my mind—without selective interest, experience is an utter chaos. Interest alone gives accent and emphasis, light and shade, background and foreground—intelligible perspective, in a word. It varies in every creature, but without it the consciousness of every creature would be a gray, chaotic indiscriminateness, impossible for us even to conceive." [1]

The question of interest is one that has received much discussion of late. It is a very important question, and its interpretation affects vitally one's whole method of teaching, and it is even determinative of subject-matter from the kindergarten through the university. Even yet it is very erroneously interpreted by many. Its answer as exemplified in the daily training of children is coloring our whole national existence. Such points as the following are involved: Shall the child follow his own pleasure in determining what his activities shall be? Or, should the educator set up certain ideals, the attainment of which necessarily involves the pursuit of activities, many of which may be even distasteful to the child? Should we seek to keep the child happy or should he be brought to feel the seriousness of life? Should pleasure-giving means be employed in instruction so that the child forgets that he is working? Should learning become as nearly as possible play? Or, should the play element be wholly eliminated from tasks? Again we have the more ultimate and equally complex problem whether interest is to be

[1] James, *Principles of Psychology*, I, pp. 402–403.

a *means* of education or an *end.* That is, shall the child be interested in order that he may understand things, which are possibly disagreeable, but deemed necessary for his welfare, or should he learn things in order that he may develop or have created certain desirable interests in life? If interest is to be a means, then shall we try to secure interest in the thing itself—*immediate interest*, or should we secure a *mediator* through which interest may in turn be secured and through which we may smuggle in the otherwise uninteresting?

Interest as a Means.—The average teacher seems to regard all interest as *mediate;* a sort of sugar coating which will render bitter pills less objectionable. So many pages of arithmetic are to be mastered and devices must be sought which will help accomplish the end. Under the guise of one thing, if needs be, the child must get another thing. New words are to be called fishes in a pond; leaves called fairies; geography lessons called journeys, etc. The young teacher is apt to think, and many teachers of pedagogy lead them to believe, that interest is largely a matter of *manner of presentation* of a subject. It is supposed that by proper skill, sufficient smiles, a lively manner, and plenty of amusing stories any subject can be made interesting to any pupils. The whole interest is supposed to inhere in the teacher. To keep the pupils good-natured, to keep them in school, to avoid conflict, to cause them to like her, seem to be the dominating influences in many teachers' work. They seem to regard all effort as opposed to interest. Such teachers seldom care what kind of interest is felt in the subject after the task has been accomplished. Will the pupil choose this subject later on? Does he apply it to his daily life with pleasure, or does he drop it out of his existence when it ceases to be his lesson? These results do not seem to be of concern.

Interest to such teachers means pleasure, amusement, having a good time. They usually feel that struggle, work, overcoming of obstacles are antagonistic to interest. In planning to keep pupils interested they usually try to amuse them, to relieve from difficulties, to smooth the path. "It is often claimed that if

there is dulness and disgust with a study it is the fault of the teacher. As Mr. Quick says: 'I would go so far as to lay it down as a rule, that whenever children are inattentive and apparently take no interest in a lesson, the teacher should always look first to himself for the reason. There are perhaps no circumstances in which a lack of interest does not originate in the mode of instruction adopted by the teacher.' This statement assumes that all knowledge is about equally interesting to pupils, and everything depends upon the *manner* in which the teacher deals with it." [1]

Interest as an End.—But while it is desirable to produce interest in order to secure study, interest as an end is desirable. One of the great aims of education should be to stimulate abiding interests in the studies themselves, and also to make the studies lead to permanent and desirable life interests. Spencer tells us[2] that, "As a final test by which to judge any plan of culture, should come the question,—Does it create a pleasurable excitement in the pupils?" Again he says that if a given course of study "produce no interest, or less interest than another course, we should relinquish it." McMurry says: "The common understanding has been that instruction is aiming at knowledge, and that interest is one of the means by which that aim can be best attained; in brief, knowledge is the end and interest is the means. But the new stand-point asserts interest to be the highest aim of instruction, and ideas to be the means by which that object can be reached; that is, interest is the end and knowledge is the means. Thus the tables have been turned. There is now a strong inclination on the part of many to measure the success of years of teaching not by the quantity of information one possesses on Commencement Day, but by the degree of interest engendered in the lines of study followed. The attitude of the mind toward study is, to them, the most important point." [3] Herbart regarded interest as the chief outcome of the pursuit of the course of study. Not only should interests in the particular

[1] McMurry, *Elements of General Method*, 5th ed., p. 73.
[2] *Education*, p. 127.
[3] *Educational Review*, 11, p. 147.

subjects become deep and abiding, but they should have fertilized a variety of larger and more universal interests. This is what he means by many-sidedness of interest.

Effort versus Interest.—There are those who feel that interest should be neither an end nor a means. To make things interesting, they say, is to defeat the disciplinary effects which should characterize all education. In real life there is abundance of drudgery and if one has not been schooled in doing uninteresting tasks later life will witness continuous shirking of one's duties and responsibilities. Even James who exalts interest in many instances, advises formal training through drudgery. He says: "*Keep the faculty of effort alive in you by a little gratuitous exercise every day.* That is, be systematically ascetic or heroic in little unnecessary points, do every day or two something for no other reason than that you would rather not do it, so that when the hour of dire needs draws nigh, it may find you not unnerved and untrained to stand the test. Asceticism of this sort is like the insurance one pays on his house and goods. The tax does him no good at the time, and possibly may never bring him a return. But if the fire *does* come, his having paid it will be his salvation from ruin. So with the man who has daily inured himself to habits of concentrated attention, energetic volition, and self-denial in unnecessary things. He will stand like a tower when everything rocks around him, and when his softer fellow-mortals are winnowed like chaff in the blast." [1] Now, while James is right in arguing for those most desirable habits as a result, it will be shown in the subsequent discussion that the motives which prompt their formation may be quite different from what he suggests.

Interest in Effort.—Those persons are wrong who deal with the case as a question of interest versus effort. It is rather a question of the *kind* of interest. We should strive to maintain interest, and the greater the interest, the greater the enthusiasm in one's work, the better it will be accomplished. But there is no dodging the stern reality that life is full of drudgery and detail

[1] *Psychology, Briefer Course*, p. 149

work, and often interest will not attach to the thing itself or very strongly to the details of much laborious activity. The scientist, for example, has to deal with long, tedious columns of figures which must be added, averages and averages of averages found; maximum amounts and minimal differences, average errors, average deviations, and the like must be computed; all of them processes requiring drudgery which few can stand without feeling great fatigue. Now were the scientist's interest not above and beyond in something more ultimate he would never get through the task.

We do not wish to have the child do things unwillingly. Things should not be done because they are disagreeable, but neither should necessary things be omitted because disagreeable. The two are not mutually exclusive. Every one has felt more self-respect many times when he has persisted in pursuing to the finish some task involving disagreeable drudgery. I believe the farmer boy experiences such a feeling when he finishes well the field of corn among the stumps; binds the bundles in the hot harvest sun, ploughs the stony field, or repairs properly the battered fence. So, too, the child in school feels satisfaction and pride when he has a good geography lesson, a perfect spelling list, or a model page of writing, even though the mind would have feasted on marble-playing, chasing butterflies, making rabbit traps, or going swimming. A university student once said to me: "I would like to take a certain attractive course, but I have started this German; I have had no end of difficulty with it, but I feel that to give it up would be like yielding to temptation. To fight it out will be to strengthen my moral nature." Who, that has any stamina, has not worked for hours to get the right answer to a problem or a puzzle, even though the answer were of no consequence and was obtained only to be forgotten in a few minutes? Certainly the drudgery was not interesting. The interest lay in conquering, in mastery of inclination to ease, and in the end to be accomplished. The loafer would have yielded to momentary ease. The future would have been dismissed. I suppose every book that has been written has involved much

drudgery, and only a more remote interest has borne the author to the finale. Even to think the individual sentences, much less to write them, is not easy nor alluring to most people. The interest in the anticipated result is what stimulates them to action. Every book, regardless of its intrinsic worth, represents moral persistence, and moral mastery in silencing the siren beckoning to momentary indulgence and pleasure. The indolent mind abhors details. It deals in unverified generalities. The master mind, although it may soar to heights unglimpsed by the indolent mind, yet has derived these generalities from a mass of detail which it has carefully scrutinized and weighed and sifted. The lazy mind deals with general statements or expressions, received at second hand and not with generalized products of his own thought.

There is interest in meeting with difficulties to cope with. Paulsen says if we could have a life devoid of struggle, a trial of it "would soon cause us to regret our choice, and make us long for our old life with all its troubles and sorrows and pains and fears. A life absolutely free from pain and fear would, so long as we are what we are, soon become insipid and intolerable. For if the causes of pain were eliminated, life would be devoid of all danger, conflict, and failure—exertion and struggle, the love of adventure, the longing for battle, the triumph of victory—all would be gone. Life would be pure satisfaction without obstacles, success without resistance. We should grow as tired of all this as we do of a game which we know we are going to win. What chess player would be willing to play with an opponent whom he knows he will beat? What hunter would enjoy a chase in which he had a chance to shoot at every step he took, and every shot was bound to hit? Uncertainty, difficulty, and failure are as necessary in a game, if it is to interest and satisfy us, as good luck and victory." [1]

Interest the Prime Consideration in Education.—All learning which is not the outcome and accompaniment of pleasurable interest fails to call forth genuine self-activity and does not give

[1] Paulsen, *A System of Ethics*, p. 260.

training. Moreover, the influence is not only negative but positively dangerous. It produces divided attention and, as Dewey remarks, "the theory of effort, as already stated, means a virtual division of attention and the corresponding disintegration of character, intellectually and morally. . . . A child may be externally entirely occupied with mastering the multiplication table, and be able to reproduce that table when asked to do so by his teacher. The teacher may congratulate himself that the child has been so exercising his will power as to be forming right intellectual and moral habits. Not so, unless moral habit be identified with this ability to show certain results when required. The question of moral training has not been touched until we know what the child has been internally occupied with, what the predominating direction of his attention, his feelings, his disposition has been while engaged upon this task. If the task has appealed to him merely as a task, it is as certain psychologically as the law of action and reaction is physically, that the child is simply engaged in acquiring the habit of divided attention; that he is getting the ability to direct eye and ear, lips and mouth, to what is present before him in such a way as to impress those things upon his memory, while at the same time getting his mental imagery free to work upon matters of real interest to him." [1]

The greater the amount of interest the better. No one ever accomplished much in any direction until he gave himself to his task body and soul. The scriptural injunctions: "Whatsoever thy hand findeth to do, do it with thy might;" and "Thou shalt love the Lord thy God with all thy heart, and with all thy soul, and with all thy mind and with all thy strength, etc.," contain the key to the secret of success. It is not advocated here that work should be made disagreeable. Even though a given occupation may seem dreary, exhausting, irksome, the whole of which this unit is a part should be of absorbing interest. The end to be attained should be so alluring that no amount of disagreeableness could drive us away. As I write these pages the

[1] Dewey, *loc. cit.*, p. 9.

mercury is mounting daily to 110° in the shade. My room seems stuffy and almost unbearable, perspiration makes my garments sticky, my sweaty hands soil the paper, and the hot wind occasionally seizes my paper and takes it pirouetting across the room. All these are annoyances, sufficient to drive me from writing pedagogics to seek Lake Superior breezes. No one has set me the task of writing. I am free to go to Lake Superior. Then why do I persist? I answer, interest in the result. I may see the necessity of formulating properly certain conclusions for my classes next year, or I may be eager to measure my strength, to see what I can do. I may be pleasantly dreaming of the converts to my doctrines, or of the money that will seek my coffers. Any of these possible ideas may have become fixed in my consciousness. It is the imagined end, possibly a will-o'-the-wisp but nevertheless pleasing and soul-absorbing, that is impelling me on. While the phantom is bright I forget the petty annoyances of heat, moist hands, noisy children, rumbling wagons, and clouds of heated dust. I am living in the alluring result—I am genuinely interested. As Adams has said: [1] "The theory of interest does not propose to banish drudgery, but only to make drudgery tolerable by giving it a meaning. We have seen that what is interesting is by no means necessarily pleasant; but it is something that impels us to exertion. If pleasure be the sole object the teacher has in view in cultivating interest, he will fail miserably."

Holman writes: [2] "All the energy of the self is given up to the endeavor to obtain the desired end. There is a conviction, more or less explicit, that unless the end is secured the self will suffer either negatively (through loss of pleasure) or positively (through incurring pain). So that if the end is gained, there is a feeling of self-realization, that is, with regard to the experience, the self is what it ought to be. This is best illustrated, in its extreme form, in the case of faddists, enthusiasts, religious devotees, etc." Hence the value of a strong headway of interest.

[1] *Herbartian Psychology Applied to Education*, p. 262.

[2] *Education*, p. 124

It is interest that leads the child to chase butterflies and to go fishing. It is also interest which impels the scientist to his unceasing toil, the author to his pen, the politician to his party issues, the philanthropist to his labor of love.

Instincts and Interests.—Interests are primarily a function of instincts. Secondarily they are determined by environment and education. Of course, interest in a particular object is not determined by instinct; but the type of interest is determined in broad outlines by instinct and heredity. The hound is interested in the chase, the lion in stalking its prey, and the cat in stealthily creeping upon its victim. The boy is naturally interested in warlike, savage plays, the girl in dandling her dolls, the mother in sacrifice for her infant child. The child's dominant interests are selfish. With the approach of manhood sex-interests, home-making and the religious interests, make their appearance. As instincts have their periods of nascency, full bloom, and decay, likewise interests growing out of the corresponding instincts have their periods of birth, growth, and decay. The presence of deep, abiding, general interests indicates the possession of corresponding instincts. Conversely, the absence of a given type of interest signifies the absence of concomitant instincts. No one ever possesses a genuine interest in any line of action without possessing native power in that direction. Persons devoid of musical ability never voluntarily manifest a persistent interest in producing music. They may enjoy hearing others perform, but their interest will be too feeble to impel them to actual participation. Those without athletic ability (potentiality, instinct) never are deeply enough interested to participate to any extent. Those who sit on the bleachers and yell themselves hoarse are not necessarily interested in athletics. They are more likely to be interested in the sport because of a sort of gambler's interest, or because of interest in the institution represented. Genuine interest in anything impels one to active participation in it.

The foregoing facts have an important bearing upon teaching. The boy who is not interested in his mathematics and, though diligent, cannot become interested, probably has no instinct—

no ability for it. The one who is slow to develop an interest in languages, in music, or in drawing, presumably is deficient in power, ability—instinct—in those particular directions. Lack of interest and corresponding ability at any particular period do not necessarily mean permanent lack in the given direction. Oftentimes a power is dormant, the nascent period has not appeared. Unfortunately sometimes, alas too frequently, it may mean that a nascent period passed without proper stimulation. Frequently when the child is uninterested in his arithmetic he has not arrived at the period when arithmetical thinking is sufficiently developed. Successful accomplishment is necessary to the continuance of interest. The child, as well as the adult, who continually fails through inability soon displays distaste for that particular activity. At a later time when association fibres have matured, relational thinking can be engaged in, and abstract mathematical thinking may be a delight. The fundamental cause of shifting interests is the fact of changing powers—instincts—through processes of development. To be sure, lack of interest may not be due to lack of ability, but no other cause is so largely responsible. Consequently any lack of interest should excite suspicion and cause investigation to determine whether there is a deficiency of native power in the given direction or a defect in the means or manner of approach to the activity.

Children's Egoism.—The child's early instincts are selfish. He cares little for aught except his own egoistic pleasures. They are not mere animal pleasures, as of eating and drinking to satiety, basking in warmth, and so on. Most of his egoistic pleasures are psychical and of a high order. His delight and satisfaction in mental accomplishments are attested in an infinitude of ways, from the repetition of striking a table with a spoon to hear the sound up to the acquisition of intricate language coordinations, making collections, and amassing funds of information just for the satisfaction of knowing and discovering.

The child's egoistic nature makes him easily interested in competition with his fellows. This is perfectly healthy and in no wise dangerous unless carried to extremes. By degrees the child

may become interested in doing things from more altruistic motives. He comes to desire to please his teacher or his parents. The desire to please his teacher and to stand well in the eyes of his fellows plays a very important rôle in keeping the child industrious at proper activities. The child whose parents are interested in his accomplishments has a much greater incentive to work than the one whose parents are indifferent to his childish activities. Sympathetic interest by the parent in hearing of the child's progress in reading, in praising his writing, his drawing, etc., exercise very important influences. Honest praise is very desirable in helping to maintain interest. Nobody, least of all a child, wishes to do tasks unnoticed. They are naturally interested in winning favor, place, or other rewards. Then there is a negative factor which stimulates and may even heighten interest —namely, the fear of loss of position, loss of caste, degradation, or even punishment. The place of healthy fear has been discussed under the feelings.

Growth of Altruism.—Lastly come the altruistic interests in which others rather than the self form the centre of consideration. Although germs of these interests appear early, it is only with approaching adult life that egoistic interests are subordinated to altruistic ones. In many, shall we say the majority, they never become very strong. The evolution of the teacher or minister illustrate very well the characteristic development of interests from the lower to the higher. Work and study are at first undertaken for the purpose of self-improvement, and for the purpose of gaining a certificate or license. This certificate is desired because it will bring personal reward in the way of position and pecuniary remuneration. Later the work is pursued for the sake of the pupils or the pastoral flock, and later still for the sake of humanity in general. Finally the deepest religious interests come to full force. This is the highest altruistic interest. True religious interest concerns itself with the highest welfare of others as well as of self. Now, through all this evolution there have been developed deep and abiding interests in each accessory stage, but each one in turn has been

subordinated to the next higher one that appeared. And it is ever the ideal, largely unrealized, which forms the *motivating* interest. Each lower interest is created for the purpose of leading to a higher ideal. We should not expect the young child to be especially altruistic. If he is there is something abnormal about him. Of course, his egoism often makes it uncomfortable for his seniors, but he is simply passing through a stage which he will soon outgrow. In race history it has been necessary for the young to be selfish as a means of self-protection. It was also necessary for the race as a whole during its infancy to be selfish for similar reasons. The child is simply repeating this racial epoch. With the oncoming of adolescence the budding of altruism ought to become thoroughly apparent. This is the time for ministration to such impulses if ever they are to be developed.

The Child's Interest in the Concrete and Objective.—The child is at first interested in what stimulates his senses. He is attracted by what he sees, hears, touches; not for what the stimuli signify, but out of pure sense-gratification. Watch the babe follow a light, turn toward sounds, express gratification at tactile contact with things. External objects and parts of his own body are handled, just for the pleasure of touching. For a good many years the child is attracted by sensory stimulation. What is bright colored, full of motion or sound will attract. As his attention becomes directed toward and centred upon things by these means, he gradually learns about things, and then apperceptively he becomes interested in new things which bear a relationship to what he has already understood. At this early stage it is legitimate and necessary to make things attractive to the senses. Bright-colored pictures, various colored letters, pleasing tones, rhythmical jingles, exercises full of motion and muscular activity, as motion songs, doing things, and making things, must be brought into requisition. The child-mind deals with the concrete and any education that attempts to foist abstractions instead produces but a veneering which is sure to scale off. As much work as possible in the school-room should

be occupied in doing—"learning by doing." It not only fosters interest but actually renders knowledge more clear and definite. This has been illustrated for several subjects in the chapter on training the senses and training the imagination. In arithmetic there are multitudes of places where the objective and constructive work can be brought into requisition. In denominate numbers every measure should be handled. The pupil can measure the school-room, the wood-pile, the coal-bin, the water-pail, etc. All the various problems should be *experienced*, at least until understood, before attempting a solution. For example, here is a post whose height is known and the length of a building or height of a tree is desired. Have the shadows measured or the triangles actually constructed until all the conditions are fully grasped. A half-hour spent out in the yard making measurements and getting all the conditions, instead of hours of aimless frittering with the symbolism of arithmetic inopportunely introduced, will make the task pleasant and profitable. It will mean something and the pupil will be vitally interested. Detach studies from life and much interest is sapped from childhood.

It is easy to enlist the interest of children in nature about them. Here, as in all cases, apperception is the basis. The farmer boy often goes through life seeing little of the wonderful things about him, simply because he has never been taught to see. Teach him that geological forces and botanical processes have a relation to all life about him and a new world is opened up. Give country children a few of the obvious facts concerning plant life, growth, circulation of sap, fertilization of flowers, relation of bacterial life to plant growth, something concerning food ingredients in soil, rain, and air, the action of light on plant growth, some of the easy principles of horticulture, fertilization, etc.; gently, tactfully dispel some of the many superstitions and saws relating to life and growth and they become new creatures —their eyes will be opened, they will be born again. A few facts like the above can easily lead them to the perusal of books like Darwin's study of vegetable mould and of earthworms, and

into a perusal of his *Origin of Species*—into science. The first geological interest I ever acquired came through being told (through chance reading!) about the action of frost upon ground ploughed in the fall. My interest was immediate. I wanted to know what would give better crops. The interest kindled and widened and has not died out. The introduction of the study of elementary agriculture into the country schools would give a new worth to country school instruction.

Interest in Means and Ends.—Dewey says in this connection,[1] after identifying interest and self-expression: "There are cases where self-expression is direct and immediate. It puts itself forth with no thought of anything beyond. The present activity is the only ultimate in consciousness. It satisfies in and of itself. The end *is* the present activity, and there is no gap in space nor time between means and end. All play is of this immediate character. All purely æsthetic appreciation approximates this type. The existing experience holds us for its own sake, and we do not demand of it that it take us into something beyond itself. With the child and his ball, the amateur and the hearing of a symphony, the immediate engrosses. Its value is there, and is there in what is directly present. . . . On the other hand, we have cases of indirect, transferred, or, technically, mediated interest. That is, things indifferent or even repulsive in themselves often become of interest because of their assuming relationships and connections of which we are previously unaware. Many a student, of so-called practical make-up, has found mathematical theory, once repellent, lit up by great attractiveness when he studied some form of engineering in which this theory was a necessary tool. The musical score and the technique of fingering, in which the child can find no interest when it is presented as an end in itself, when it is isolated, becomes fascinating when the child realizes its place and bearing in helping him give better and fuller utterance to his love of song. It is all a question of relationship, whether it appeals or fails to appeal; and while the little child takes only a near view of

[1] *Loc. cit.*, p. 15.

things, as he grows he becomes capable of extending his range, and seeing an act, or a thing, or a fact, not by itself, but in its value as part of a larger whole. If this whole belongs to him, if it is a mode of his own movement, then the particular gains interest too."

"What use can be made of this?" is one of the common questions asked by children. It is not an idle question with them either. It represents a deep-seated interest. I have noticed children very apathetic over lessons on coal, iron, and other minerals, as long as the emphasis was put upon classification and other, to them, abstract considerations. But as soon as the idea of its utility in the economy of civilization was introduced they were all aglow with enthusiasm. They care little for classification and scientific principles. They have not reached the age for that, but, What is it for? How is it used? How does it affect them? are all vital considerations. In this very instinct lies a very strong leverage for securing efficient work from children. Children often imagine ideal states which they wish to attain, but if they do not form these images for themselves they should be led to build them, for the pursuit of ideals constitutes the essence of progress. With these ideals alluring them, they can usually be shown the necessity of their studies in attaining the ideals. A boy who hates arithmetic but lives in contemplation of machinery can easily be led to see that mathematics is the key to its understanding and construction. Due consideration of the relationship between mechanics and arithmetic will undoubtedly produce interest in the arithmetic, but the road will be indirect. After early childhood our interests are very largely incited in this fashion. The boy learns his lessons because by so doing he can gain favor, rank, prestige; because they will enable him to accomplish something else. His reading, he comes to believe, will reveal entertaining stories, his writing will enable him to write to grandma, etc.

Children's own stories and spontaneous drawings are full of ideas of action, and especially actions related to use. Binet records[1] the results of some tests made upon his two little girls,

[1] *Revue Philosophique*, December, 1890.

two and a half and four and a half years old. He asked them what they meant by a number of words they used, such as horse and clock, and wrote down their answers. Their answers indicated that they were most interested in the use, and next in order came the movements. They seldom described things by color, form, or size, but told what it could do or for what it was used. Barnes tried essentially the same experiment with more than a thousand children and found that their definitions were in the following order: By far the larger number from six to twelve years, explained in terms of use. Next in order came definitions by placing under a more generic term, as: "A dog is an animal." Third in order was action; fourth, quality; fifth, place; sixth, color; seventh, form; eighth, structure; ninth, substance. With increasing age the tendency to explain in other terms than use increased. At all ages up to fifteen use was very strong in all their explanations. Barnes says: "In looking at the chart of seven-year-old children one is struck with the preponderance of the definitions of *use*. Children at this age consider that they have told you all about an object when they tell you what it is good for. 'A horse is to ride,' 'A mamma is to take care of children, and a box is to put things in.' To the young child all things exist to meet some of his own particular wants; thus, 'A village is to buy candy in;' 'A bird is to make meat with, or is good to lay little eggs;' 'A dog is good to catch flies;' 'A mamma is good to cook, or to whip little children.'" [1]

An illustration borrowed from Adams is to the point:[2] "John was a perfectly normal type—clever and very careless. Suddenly the mathematical master reported an amazing improvement in John's marks. On investigation the improvement was found to limit itself to mensuration. Still further inquiry narrowed down the prodigy to segments of circles; but as those could not be understood without previous work, John asked and obtained permission to work from the beginning. In three weeks he had bored his way honestly through half of Todhunter's *Mensuration*, and was very eager to be promoted to the volumes

[1] *Studies in Education*, I, p. 207. See also p. 227.
[2] *Herbartian Psychology Applied to Education*, p. 264.

of spheres. John was now the talk of the master's room, where nobody had a good word to say for him except the science master, who reported that John had developed a violent interest in chemistry, and was showing leanings toward volumetric analysis. The whole trouble was afterward traced to its primary bacillus in a gigantic balloon that John was projecting. How to cut the gores drove him to Todhunter; how to calculate how much zinc and sulphuric acid were necessary to float his balloon with hydrogen had urged him to chemistry. Balloon-making did not make either mensuration or chemistry easy; it made them interesting."

A business man desires to accomplish certain business ends; it may be the selling of sewing machines in Europe, but a lack of knowledge of the languages stands in the way. He sets himself assiduously to mastering those languages. At first the interest is not primarily in the German, the French, or the Scandinavian; it is avowedly in selling sewing machines, but once they are learned undoubtedly an interest is built up in the languages for their own sakes. This probably differs little from the course of development of the philologist. He, of course, ultimately develops a much deeper and more lasting interest in the study for its own sake; but ordinarily he has started out interested in making a living, securing certain rank, or with the intention of becoming a teacher. Much in the same way one goes to college. A college education is a necessary qualification for our ideal society, business, entertainment; it will furnish us a passport through many desired portals. We shall have to admit that these are utilitarian motives, but probably no study is voluntarily taken without some such motive. It could not be otherwise. Lack of apperceptive ideas prohibits us from being interested in a subject of which we know nothing. This is not to say that a genuine interest may not be awakened in the study as soon as it is revealed to us. After all, are not these higher motives than taking subjects simply because one is assigned them by a taskmaster or because they are in a required curriculum?

McMurry says that "It should be remembered that motive

cannot be eliminated from drudgery, and that the way to prepare for the latter is to develop, not a formal power, but a strong motive. Motive has its origin in interest. Hence, so far as instruction is concerned, the chief preparation for drudgery that the teacher can give is a strong and many-sided interest."[1] Dewey maintains that when genuinely interested in the results to be attained we are equally interested in all the details necessary for the realization of that end. He says: "A genuine interest in the ideal indicates of necessity an equal interest in all the conditions of its expression." He further says that the finished form is completely transferred over into these special acts. It would hardly seem as if this were true. For example, in writing this chapter, I cannot see that the pasting together of the scraps of paper made by my scissors has any fascination for me, and much less the wearisome rewritings; but still, by the ideal which motivates me I am enabled to lay hold of this otherwise irksome work and almost forget the toil and the drudgery in the zeal for giving expression to what I regard as truth which I fondly imagine the world to be awaiting. Marking large bundles of examination papers is a part of a good teacher's work, and every one of the craft is interested in being the best of teachers, but toward the hundredth paper one's interest in that particular activity cannot be said to be very tense, though he is sincerely interested in maintaining a reputation as a good teacher.

However, whether one is really interested in his trials and tribulations because they are units in the accomplishment of a zealously pursued ideal, or whether they are momentarily forgotten, is a minor matter pedagogically. The significant fact is that because of the relationship of whole and part, and through the intensity of interest in the whole one is enabled to buckle to and without too much pain accomplish the parts. When the end is pleasing and alluring the means either become interpreted as pleasurable because a part of the whole, or are dropped out of consciousness altogether, just as an ugly feature is not thought of in a friend with a beautiful character.

[1] *Educational Review*, 11 : 155.

Dewey maintains that even with children activity in any given direction should spring from a need experienced by the individual in realizing his higher self. The child, for example, should learn to read when he feels the need of it in realizing his ideal self; and he should learn the multiplication table when his ideal self demands a knowledge of computation as a means of realization. This is difficult to see in all its aspects, especially when the child's ideals are so vague and fleeting. It would seem as if in this stage prescription must determine much of the activity which will aid in the perfect realization of the ideal which superiors believe is in harmony with the child's needs and possibilities. But certainly it is right to secure these relations between work and ideals in increasing degrees through life. "The genuine principle of interest is the principle of the recognized identity of the fact or proposed line of action with the self; that it lies in the direction of the agent's own growth, and is, therefore, imperiously demanded if the agent is to be himself. . . . Genuine interest in education is the accompaniment of the identification, through action, of the self with some object or idea, because of the necessity of that object or idea for the maintenance of self-expression."[1]

Processes or Results?—The adult does not feel the exhilaration that the boy does in merely going through processes. The boy, the pedagogues to the contrary notwithstanding, does derive a good deal of satisfaction in merely working examples, getting answers which are speedily forgotten. The more mature one becomes, the more remote the interest may be. Children even take a great interest in learning words, words, words. Watch the child dig a hole only to fill it up again, or cut up paper just for the pleasure of the cutting. Their early games have even no culminating points—no one to be caught, no one to be tagged, no one to be "it," etc. The mere activity, physical and mental, is in itself interesting to the child. I have heard children as old as five years talk to themselves, incoherently, making up the dialogue as they went, for an hour at a time. The same thing is illustrated in the child's early babblings. The production of

[1] Dewey, *loc. cit.*, pp. 9, 12.

sound seems to be the end in view. It may even be mere activity of the vocal organs. In the early stages of learning to read I have seen my child of five spend half an hour at a time in merely reading the meaningless letters and skeleton sentences, such as, "I . . . how—the . . . fly." She did not supply the missing words. I have even tried to persuade her to take another lesson. But she was reading continuously and would leave no part omitted. My boy of ten works arithmetic by the hour just for the pleasure of working. In all such cases the process and the product are identical—the process is the product, the means is the end.

But we must not be deceived. The great mainspring to action in all orders of life is interest in achievement—in results. We must not be led to believe that school-children will accept cheerfully all assigned tasks because of an inevitable interest in action—in processes. It is only when we can cause them to feel a worth in the result that we can secure genuine and continuous interest. School activities are frequently too far removed from reality. Children like to do and accomplish real work. A boy in the kindergarten said: "I don't want to play drive nails; I want to drive some real nails with a real hammer." Now, too much occupation for children is playing at driving nails. Every one is more interested in results than in processes of securing results. In life it is results we desire. The processes are only means to ends. All nature has been interested in securing results. Educational theory, however, has erroneously conceived educational values to lie in the processes. It is said that the process of learning the arithmetic, the algebra, or the Latin, are the important things; the resulting knowledge of arithmetic, algebra, and Latin are inconsequential, compared with the value of the processes. Learning, therefore, is often a purely formal affair. In the chapter on formal discipline this theory is critically examined and shown to be untenable. Even in manual training attempts have been made to exalt the value of the process and to minimize the value of products. A little observation of pupils engaged in manual training should show that the child is primarily

interested in the product. The sled, the box, the Christmas present he is constructing make the process worth while. Let him be asked to go through purely formal "exercises" without making anything and note the dwindling interest.

Can we not regenerate all our subjects of instruction by putting real, worthful results into the foreground? Why not have pupils write real letters, work concrete real problems growing out of spontaneous activities, study living problems in civics connected with every-day life, make geography, like charity, begin and end at home, read to know, recite to give information, and in all teaching have the work spring out of the demands of life and be made to contribute to them. Of course, much must be studied which is only remotely connected with desired results. In such work it is the duty of the teacher to reveal the living relations between the subject and the pupil's life, and to show that it will contribute to wished-for results. The boy who regards algebra and Latin as mysteries evolved merely for schoolboy occupation is never interested; but the boy who glimpses that algebra will unlock hidden secrets in electricity or that Latin may contribute to his efficiency as a lawyer is aglow with enthusiasm over the results and is willing to master the processes.

McMurry writes that "In the business world and in professional life men and women work with abundant energy and will because they have desirable ends in view. The hireling knows no such generous stimulus. Business life is full of irksome and difficult tasks, but the aim in view carries people through them. We shall not eliminate the disagreeable and irksome from school tasks, but try to create in children such a spirit and ambition as will lead to greater exertions. To implant vigorous aims and incentives in children is the great privilege of the teacher. We shall some day learn that when a boy cracks a nut he does so because there may be a kernel in it, not because the shell is hard." [1]

Imitation, Suggestion, and Interest.—Imitation and suggestion are very potent means of securing interest among children. They instinctively exhibit first curiosity and then genuine delight

[1] *Elements of General Method*, p. 67.

in what interests their mates. They are also responsive to bursts of enthusiasm on the part of those whom they respect and admire. Parents and teachers who cannot warm up over the activities that appeal to child-life are lacking in very essential qualities of child-leadership. One of the highest compliments that can be paid a teacher is that he seems like a student in his eagerness. Leadership is more to be desired than policemanship or taskmastership. "Teaching is really a matter of contagion rather than instruction. His (the child's) leader must therefore be a person of character and self-control. He loves his leader and wants to do for him. His leader must be a person of ideals who can offer him good and true things to do." [1] It is necessary to distinguish carefully between genuine interests and spurious ones engendered through imitation. Often pupils think they are interested in a subject simply because their acquaintances have the same attitude toward the subject. True interest can only develop through knowledge. Consequently it is only after the pupil has given a subject a fair trial that we may know whether or not he is interested.

Apperception and Interest.—It often happens that pupils are not interested in a subject when it is first begun, but after they have pursued it for a time it becomes pleasurable to them. This is to be expected. We are really interested only in those things about which we know something. Moreover, the more we know, the deeper usually becomes our interest. Interest is cumulative. While knowledge increases in an arithmetical ratio, we may say that interest increases geometrically. This may not be wholly true of children's interest because with them so much depends upon novelty and change. But it is true of adults. As soon as one's knowledge really becomes a part of one's mental system; when all activities of life are fitted into this system; when one begins to shape all thoughts, feelings, and actions by this knowledge; then one may be said to be really interested. The business man who sees stocks in everything, the doctor who constantly discovers cases to enlarge and support his medical theories; the

[1] Forbush, *Pedagogical Seminary*, 7 : 341.

sociologist who discerns a sign of a great social movement in every individual's act, is really interested. I say to my students: "You will not be good teachers until your days and nights, your waking hours and your dreams are filled with thoughts of your work and you are possessed with a burning desire to better your work, until you have thought about it enough to make it the great passion of your life—completely living that life which you have erected as an ideal." No one ever arrives at that stage of burning zeal and enthusiasm without first having studied long and deeply.

The subject matter must be adapted to the age, capacities, and apperceptive insight of the child. Even in the university the same principle should be observed. Where entire freedom of choice obtains, the student is as liable to elect teachers as subjects, and often selects subjects for which he has had no proper preparation. Every elective should have certain prerequisites for its pursuit. We want the subject to take a vital hold upon the individual; he should form desires to pursue it; it should become a part of him so that it influences conduct. The arithmetic that is never applied in daily life spontaneously by the pupil is of little account; the history that is never drawn upon to measure present human conduct has not borne proper fruit.

If a child does not become readily interested in a lesson, it is better to seek something that will interest him. If he has sufficient apperception for the given lesson, his readiness to be influenced by suggestion will easily turn him toward your cause. Spencer says: "This need for perpetual telling is the result of our stupidity, not of the child's. We drag it away from the facts in which it is interested, and which it is actively assimilating of itself; we put before it facts far too complex for it to understand, and therefore distasteful to it." [1] "Apperception masses," according to Herbart, are really determinative of one's interests. In his psychology volition is dependent upon ideas. There is no independent or transcendent faculty whose function is to will.

[1] Spencer, *Education*, p. 126.

He believes that ideas of right will develop into ideals of conduct and that these ideals will become strivings toward virtuous action. Hence it is of great importance that the child should form interests through the subject-matter of instruction which may develop into permanent life-interests. In this view the character of the subject-matter of instruction becomes of the highest importance. Purely formal instruction in subjects that do not touch life cannot develop proper interests in life. Formal rules of language, grammar, or arithmetic cannot teach the golden rule. Hence the value of literature, history, and other humanistic studies. Interest, according to Herbart, is not a means of securing temporary attention. Interest is to remain a permanent and abiding attitude even after the particular knowledge has been obliterated from the mind. Herbart believed that these interests should be many-sided.

Self-activity.—We should seek to have the child act spontaneously as far as possible. This does not preclude influencing him by suggestion and guidance toward a desirable line of action. But we should try to have the child form a desire to reach a certain end or conquer a difficulty for himself. When the child's self-activity carries him forward, it is astonishing what results may be accomplished. They are incomparable with those obtained through doing prescribed tasks. "The spontaneous activity to which children are thus prone, is simply the pursuit of these pleasures which the healthful exercise of the faculties gives. . . . Children should be led to make their own investigations, and to draw their own inferences. They should be *told* as little as possible, and induced to discover as much as possible." [1]

There are thousands of ways in which their interest may be aroused in discovering things for themselves and accomplishing results unaided. Normal, active children will even resent help. They say, "I want to do that myself." They prove this when building with their blocks, when playing their games, in the various manual activities, and sometimes even in the school

[1] Spencer, *op. cit.*, pp. 124, 127.

arts. Who has not seen children delighted at discovering analogies in forms of objects and in the use of things? Discovering the spelling and pronunciation of words, for example, may be made a most delightful exercise. The study of plant and animal life affords great opportunities for the independent discovery of analogies. The child is essentially an analogical reasoner. There is ample opportunity in all subjects to have pupils work out independent conclusions. Even in history which is so often memorized in a purely mechanical manner, questions may be propounded which invite independent judgment. For example, have the class answer such questions as the following: Should Gates have been commander-in-chief? Should Fitz-John Porter have been court-martialed? Was Hayes elected president? Was the purchase of Louisiana unconstitutional? Was the purchase of Alaska advantageous? Was the Cuban war justifiable? A similar procedure in literature would infuse new life into what is often dry and uninteresting.

Aim, Responsibility, and Interest.—A definite aim should be inculcated very early in the child's mind. This aim may and should undergo metamorphosis with added experience. The boy's aim should be more immediate than his father's, to be sure, but an aim he should have and that should be tenaciously striven for. No child should grow up irresponsible. Responsibility promotes interest and gives zest to life. The main differences between country and city-bred children do not result because of differing amounts of ozone which they have inspired; but because of the more permanent interest in tasks and the greater fidelity to responsibilities placed upon the country children. That is one potent reason why so many great men have been reared on the farm. Because of the relief from all continuous tasks and from all responsibilities, the city boy has not learned to be interested in performing *duties*. He is apt to be interested in the things of the moment, those which compel attention, those which are entertaining or amusing. The country boy is early habituated to perform tasks because they are duties. Work must be done, some one must perform it. His father works

steadily. The hay *must* be cut, or spoil; the stock must be fed, or go hungry; the fence must be mended, or danger will result to the crops; wood must be cut and brought in, or dinner will be late. He hears every one say *must*, and through habituation to work and reflection upon consequences, he, too, learns to say that "this and that *must* be done, and they seem to fall to me; I *must* do them." The city child unfortunately misses all this. He seldom feels the impelling "I must," except "I must get my lessons, or get punished." But he is seldom taught to be on the lookout for work. The assigned lesson over, he casts himself adrift, oftentimes to be caught in currents that lead to mischief. The country child has few playmates and few playthings; the city child has so many that he is surfeited with them and ceases to be interested in them. Compare the boy who makes a sled with the one who has his sled and all other toys bought for him. The one is interested in *achieving* an *end*, the other is merely temporarily amused. Compare the boy who makes a collection of eggs with the one who merely goes to the museum. The one who collects will have deeper, healthier interests than the one who can go at any time but who has never attempted to make a miniature museum. The girl who has some part in making her own dolls secures a satisfaction that is unapproachable by the *poor rich* child who is merely a spectator. The pleasure of being a spectator in these directions is almost as proportionally undesirable as being a spectator instead of a participant in a feast.

On the farm it is comparatively easy to promote interests in a variety of directions. With little suggestion the child can be made to have a deep interest in animals and plants. One of the surest ways to launch these interests is to make the child a copartner, a profit sharer. Had farmers any pedagogical tact there would be little difficulty in keeping boys on the farm. Could certain patches of ground be set apart for the boys' own use, could certain animals be given them to care for and to own, they would not only be interested in those projects but they would become identified with the interests of the whole farm. There, as in every walk of life, no one wants to be merely a spectator. Of

course the social question enters here, but the same rule must apply; make the young people copartners in working out better social relations. Prescription without co-operation is fatal here as elsewhere. No greater enthusiasm has ever been kindled in my own life than in the co-operative attempts at evolving a country lyceum, and in the attempt to work out with my father better methods of raising certain crops.

One of the gravest mistakes in the present-day education from the kindergarten through the university is the failure to impress thoroughly the duty of individual responsibility. It has come about largely through a misinterpretation of the doctrine of interest and the belief that the child develops a better type of will when freed from restraint. Freedom from restraint has come to mean absolvence from duties and from training. On every hand the doctrine is spread that we ought to follow the lead of the child's interest. This is good pedagogy when we follow a child's interest which has come about through a healthy and normal development. But there are many perverted and unhealthful interests. It is manifestly wrong to accede to the child's wishes in such cases, simply because he is interested. Moreover many apparent interests are mere passing whims. I believe it is as important that the parent and teacher create interests, as that they permit children to follow their own interests. More than that, the teacher and parent should instil it into the minds of children that it is a duty incumbent on them to be interested in right, important, and uplifting things.

I believe it is not due to a fit of indigestion that I am led to feel that children of the present are not sufficiently indoctrinated with the idea of duty and individual responsibility. Is it not manifest in all grades of school? Is it not manifest in the university? And is it not discernible in the home? The child goes to school and performs his tasks because he is entertained, and as soon as the teacher fails as an entertainment committee the child says mentally, and even openly charges, that because the teacher is not interesting he is not obliged to be attentive. His assigned work over, he is in mischief. He has not been

taught to set himself to work. In the high schools and colleges the youth often puts himself in a contest with the teacher, saying: "Now if you entertain me, I'll keep awake and I'll attend your classes. If not, I'll bring discredit upon you by going to sleep, or I'll elect a course somewhere else." Now the collegian who does not maintain an interest by his own initiative ought not to be in class. The adult who goes to sleep during a lecture or in church is in the kindergarten stage and ought to be in the kindergarten. His presence ought to be evidence that he is to co-operate. Duty is not taught best through preaching. The habit of attending to regularly recurring work is what teaches duty, just as the habit of being polite teaches one to be polite.

President Faunce expresses gratification that pupils learned "In the days of narrow outlook and wearisome drill at least to possess courage in the face of obstacles, and patience under monotony, and resolution to rise after falling, and that something of the granite of the New England hills was in the training of the old New England teacher. We need not invent difficulties for pupils. But we need not hide their existence. Unless our pupils learn 'to endure hardness as a good soldier,' they are not prepared for real life. In pleading for variety of approach to the pupil, we are not praising the dictum of Rousseau that 'duty and obligation should never be mentioned to a child,' and we are not endorsing the soft pedagogics of our time, or the 'flower-pot' education which would shelter the child from the sterner facts of life. When we find Robert Louis Stevenson writing from his bed in Samoa: 'To me the medicine bottles on my chimney and the blood on my handkerchief are accidents; they do not color my view of life,' we are reading the record of a soul that had been educated by more than games and toys, and had triumphed over care, and fear and pain. We shall never discover in our schools those pupils who are destined to be reformers, patriots, statesmen, leaders in moral enterprise, unless we sound the eternal note of duty, face unflinchingly the ethical facts of the universe, and in appealing to 'interest' remember

that the profoundest of all human interests is the interest in the triumph of righteousness in all the earth." [1]

Co-operation of parents with teachers is one of the surest means of producing genuine interest in school-work. The parent who does not know what his children are doing every day in school must not be surprised if some day the child plays truant or becomes apathetic toward his studies. I have never known many cases where parents were intelligently interested in the child's progress in which the child himself was not likewise interested. Many fathers are too absorbed in their banks, their merchandise, their railroad, to know anything about their children. They scarcely ever see them by daylight and never have time to talk with them and really know what they are doing. One-half the interest and concern that many a father accords to his trotting horse, his yacht, his automobile, his favorite base-ball team, accorded to an identification of interests with his children would work wonders in child saving. No wonder that the indictment is sometimes made that many men are successful in all kinds of business except rearing boys and girls properly.

Interest in Self-improvement.—Boys ought to be taught to be as absorbed and interested in their school-work as they would be if working for wages and trying to capture a bank presidency. School-work is apt to be done as prescribed tasks which it is deemed honorable to shirk if possible. Parents should take the same pains to have children please others and to succeed in school as if in a mercantile establishment. A false code of school ethics has sprung up. Children should be taught to do with all their mind and will and strength whatever seems right to do. Pitch in and interest follows. No one will ever get up a white heat of interest by waiting for interest to come before beginning a task. Assume the attitude of interest and interest will follow, is the Lange-James law of feeling, and it is certainly operative here.

Young people should learn to set themselves to work. There will not always be some one around creating artificial incen-

[1] *School Review,* 8 : 577.

tives to work, hence the necessity of learning to throw one's self into work, believing that interest will follow as soon as one becomes warmed up to his task. Far too much stress is placed upon making things interesting for pupils and too little upon enlisting their own interest and effort. Pupils are virtually taught that they are absolved from all personal responsibility and are to look to the teacher to create all interest. This is a pernicious doctrine. I have watched the career of several boys who have grown up with this idea firmly implanted in their minds. To all advice that they ought to pitch in because there was a personal obligation resting upon them to help their parents and also to make something of themselves, their only answer was, "I don't have to because I don't like that." They have reached middle life and are still seeking something which they will like. They have drifted from occupation to occupation, and from occupation to idleness, and nothing, not even idleness, has been more than momentarily interesting. This is the inevitable result of making pleasure the sole object of life. The pleasure-seeker is the least interested and most miserable being alive. Teach the children responsibility and obligation to self and to society and unflagging persistence in accomplishing in the best way "whatsoever their hands find to do" and the matter of interest will in adult life largely care for itself.

President Eliot said[1] that "Education for efficiency should supply every pupil with the motive power of some enthusiasm or devotion. The real motive power in every human life, and in all national life, is sentiment, and the highest efficiency cannot be produced in any human being unless his whole character and his whole activity be dominated by some sentiment or passion. An evil passion may give great physical and intellectual powers a terrible efficiency. A good passion can make ordinary talents extraordinarily effective. A life without a prevailing enthusiasm is sure not to rise to its highest level. These private enthusiasms or devotions are fortunately almost as various as are the characters of men."

[1] *Journal of Pedagogy*, 17 : 112.

. By the age of eleven or twelve years children should begin to feel a duty in being interested in worthy things. Something is wrong when a child of that age will take no responsibility in interesting himself; when he goes to school and throws the entire burden upon the teacher. He has no right to say that "the teacher is dry and uninteresting, therefore my responsibility for attentiveness ends." He is morally responsible for finding some interest through proper diligence and application. As previously suggested, teachers are often to blame for leading pupils to think of them as an entertainment committee. At best their stock of entertainment is not perennial and the time will come when interest, if present at all, must be a result of accumulated knowledge in the pupil's own mind. What the teacher or the books impart in a serious, undramatic, matter-of-fact manner will only prove interesting if the new ideas find congenial companionship through previously assimilated knowledge. The new notes can only vibrate in unison and harmony if the mind has previously been attuned through similar notes.

Students have no right to expect to be merely entertained. They should feel it incumbent upon themselves to contribute their share toward self-interest and also to class interest. With the wealth of well-written books now accessible high-school and college students ought to progress and maintain healthy interests in their studies, even with very indifferent teachers. This is not an apology for poor teaching. The teacher's duty in helping to maintain interest is in no way lessened. But it takes two parties to maintain good class-work—a good teacher and a responsive, responsible class. An irresponsible-minded class becomes much like the kindergarten children above mentioned, even under good tuition. The pupil must learn that interest comes through aim, responsibility, responsiveness, and apperception.

In cases where children are coddled in the attempt to make all things interesting "there is oscillation of excitement and apathy. The child alternates between periods of over-stimulation and of inertness. It is a condition realized in some so-called kinder-

gartens. Moreover, this excitation of any particular organ, as eye or ear, by itself, creates an abiding demand for such stimulation. It is as possible to create an appetite on the part of the eye or the ear for pleasurable stimulation as it is on the part of the taste. Some kindergarten children are as dependent upon the recurrent presence of bright colors or agreeable sounds as the drunkard is upon his dram. It is this which accounts for the distraction and dissipation of energy so characteristic of such children, and for their dependence upon external suggestion." [1]

Dr. E. Benjamin Andrews believes that at present in this country there is too much dependence upon involuntary attention. That is, there is too much stress laid upon pleasing children. Too many boys and girls after leaving school, he writes,[2] have a disinclination to make earnest effort of any kind. "They have not the power of strong exertion. They lack courage, resolution, 'sand.' They are afraid to take the initiative. The typical pupil of to-day must be interested (amused) before he can act. The pedagogy of gush has brought him to look to his teacher for interest, and not to find it in himself. It is beaten into his mind that his teacher must keep him attentive. If a suggested task is not interesting (pleasing) he cannot think of it as having any claims upon him. Little of the tonic that comes from driving the will to perform unpleasant duties is ever given him."

The child should not be led to expect to be amused all his life. He should learn to do properly things which constituted authority demands and thus build up right habits. Habits will beget interest through the law of overcoming resistance and through apperception. How many pupils in school work themselves up to that degree of interest where they take themselves in hand? They do this in other directions, as in base-ball, foot-ball, and other games and sports, and with great results.

Did it ever occur to you how unnecessarily long pupils may pursue some subjects and not learn them well after all? Take penmanship, for example. Most schools devote to this subject

[1] Dewey, *loc. cit.*, p. 11. [2] *Educational Review*, March, 1901.

one period of fifteen or twenty minutes daily for eight or nine years, and then not half the pupils can write a legible, rapid hand. At one time I began to reflect on the wasteful, half-hearted, abortive process. I watched the daily evolutions of these young soldiers going through the aimless (to them) manœuvres. They expected that they would have to do the same for eight years, anyway. Time enough later on to improve. Do as little as possible now. I tried an experiment. The pupils were told that penmanship would be a required exercise until they could write a plain, legible hand with fair rapidity. As soon as this degree of proficiency could be attained and manifested in their usual work each one should be excused. The results were amazing. Soon there were self-seeking candidates for the privilege of being excused. They began to coach themselves. They now had a *desirable aim which enlisted their deepest interest.* They asked for information and help instead of being unwilling recipients. The majority of the pupils were excused in either the fourth or fifth grades, and seldom was one demoted for further dereliction. A similar plan was adopted in spelling, with splendid results. They had no longer to be taught. Their interests prompted them to teach themselves. Whenever the individual instead of the class was made the basis for promotion, I found largely similar results.

To say that we ought to follow the lead of the child's interest is good pedagogy provided his interests are healthy and have come about through normal development. But there are many unhealthy and perverted interests. It is manifestly wrong to obey these. Moreover apparent interests are many times mere passing whims. It is as important that parents and teachers create interests as it is that they follow those exhibited by the child. As with instincts, some are good, others bad. The good ones are to be nourished, the bad stifled or diverted. It is not more safe to follow the child's interests than his appetites for food. Left entirely to himself in the matter, he sometimes selects pickles and jam, or superabundance of starches, rather than those things that are nutritious.

It is not a question of having the child interested, but of more importance, having him interested in worthy things. It is a mistake to think that at all events children must be happy. Happiness is desirable, but not the only desideratum. Better be less happy and more serious, if occupied with right thoughts and actions, than happy in evil or idle things. Better be serious in work than happy in sin and wickedness. Momentary pleasure in childhood does not insure life-long happiness. The child should early learn that his own selfish gratification must often be subordinated to the welfare of others—the family and society. As with instincts, we cannot trust all to the child. Rightly constituted authority must set up ideals and standards toward which individuals and society must be guided, and sometimes even coerced. Apropos of this point a paragraph from Herbart may be quoted: "Interest means self-activity. The demand for a many-sided interest is, therefore, a demand for many-sided activity. But not all self-activity, only the right degree of the right kind, is desirable; else lively children might very well be left to themselves. There would be no need of educating or even governing them. It is the purpose of education to give the right *direction* to their thought and impulses, to incline these to the morally good and true." [1] To become deeply interested in things that are worthy and ennobling is of more value than learning. The right attitude toward life is of the greatest importance. Too many are secretly or openly interested in ignoble things.

Adolescence and Life Interests.—It is during adolescence, that period of enlarged vision and superabundant life, that interests and enthusiasms are at a white heat. Out of the manifold interests then dominant some will become crystallized into the permanent life-interests. The stamp which is impressed upon the youthful life will become fixed forever. Just as conversions rarely occur in maturity, just as a criminal usually enters upon his career in the morning of life, so lives of usefulness, happiness, and virtue are launched while the heart is yet young.

[1] *Outline of Educational Doctrine*, translated by Lange, p. 60.

President Eliot wrote:[1] "Any one who has read many biographies will have perceived that the guiding enthusiasm of a life often springs early into view and that this is almost always the case in the most effective human beings. The youth has a vision of the life he would like to live, of the service he would choose to render, of the power he would prefer to exercise, and for fifty years he pursues this vision. In almost all great men the leading idea of the life is caught early, or a principle or thesis comes to mind during youth which the entire adult life is too short to develop thoroughly. Most great teachers have started with a theory, or a single idea or group of ideas, to the working out of which in practice they have given their lives. Many great preachers have really had but one theme. Many architects have devoted themselves, with inexhaustible enthusiasm, to a single style of architecture. Some of the greatest soldiers have fought all their battles by one sort of strategy adopted in their youth. Many great rulers have harped all their lives on only one string of national or racial sentiment. Among men of science the instances are innumerable in which a whole life has been devoted to the patient pursuit of a single vision seen in youth."

It is seldom that an entirely new occupation is entered upon with success after middle life. After that a splendid superstructure may be erected, but the foundations must have been laid in early life. Although young shoulders should not become bowed down by an overweening sense of responsibility, yet it is sinful not to impress the young with the importance of the morning of life. The old adage that it is never too late to mend should be replaced by the one that it is ever too late to become what one might have been, if an opportunity has been allowed to slip. Students should early recognize the importance of making the most of the morning of life. Biologists have come to recognize the economic value of the period of infancy. This is a time of plasticity, a time when the individual can be moulded and modified; in other words educated. The longer the period of

[1] *Journal of Pedagogy*, 17 : 112.

infancy the higher the degree of educability. The newly-hatched chick has a short period of infancy. On emerging from the egg it can perform almost all the activities which it will ever be able to perform. It has very little to learn, very little possibility of learning, and very little time in which to learn. The young dog has more to learn, a longer season in which to learn it, and larger possibilities of acquiring new activities. The human being has the longest period of infancy. By infancy I do not mean alone the period when the child is in the cradle. Biologically it includes all of life from birth to maturity. After this period, the possibilities of education grow less and less.

Brain workers inaugurate their best work between the ages of twenty-five and forty-five; before that they are preparing for work, after that their work no matter how extensive is largely routine. Lawyers and physicians do much of their practice after forty, but the learning was accomplished before forty or forty-five. Successful merchants lay the foundations for wealth and success in youth and middle life. The great men that we know are all old men; but the foundations for their greatness were laid when they were young. Philosophers have founded and announced their systems in youth and early manhood; divines and religious teachers have originated their creeds and have been most effective as preachers in early manhood. Statesmen have projected their greatest acts of legislation, diplomacy, and reform in early life. In the morning of life scientists have wrought out the data and practically formulated their theories; generals and admirals have gained their greatest victories; lawyers have paved the way for leadership at the bar; physicians have laid the groundwork for their greatest discoveries; poets and artists and musicians have planned and in many instances executed their greatest masterpieces; engineers have planned the greatest monuments. The war in Africa was begun with old men for counsel and the young men in the field. But before decisive results came, young men were also directing affairs.

A few instances may be cited to show that the world's leaders in all lines of progress have either become illustrious early in

life or have done the thinking which they have reserved for later expression. Dickens began early to write. *The Pickwick Papers* was produced at 25. The works which have immortalized his name were all produced before 40. Ruskin had completed the first part of his greatest work, *Modern Painters*, at 28. Shakespeare had produced some of his immortal plays before 36. Bunyan had depicted man's cycles of hopes, sorrows, and despair before 35. Byron and Burns died at 36, Keats and Marlowe at 29, and Shelley at 30. Coleridge wrote his *Ancient Mariner* at 25, Goethe and Victor Hugo had produced works of lasting value at 20. If Carlyle had died at 45 the loss to literature would not have been great. Lord Bacon had begun to philosophize at 16, and at 36 had published twelve of his essays. At 29 Descartes began to outline his system, and at 41 to publish it. Schelling was a renowned university professor of philosophy at 28. Emerson expressed the essence of his philosophy between 25 and 40. His essays first appeared at 38, though they had been uppermost in his thoughts from early manhood.

Edison was a young inventor. In fact, all inventors are young. Eli Whitney was noted at 27, Colt at 21, Fulton at 28, Dreyse at 42, Graefe at 25. Alexander the Great had conquered Greece at 21, Persia at 25, and had completed his history at 33. Julius Cæsar began to take part in the great drama for which he is remembered at 17, Hannibal at 29, William the Conquerer before 20, Cromwell before 30, Marlborough at 32, Napoleon at 25, Wellington at 25, Nelson at 39. Among artists and sculptors about three out of four have shown decided promise before 15. Michelangelo produced great works by 19. Raphael and Van Dyck painted famous pictures before reaching their majority. Rembrandt was famous at 24. Among musicians we may cite Mozart, Beethoven, Mendelssohn, Schubert, and Schumann as real producers before 20; in fact, each produced something original by 13.

If we turn to muscle workers we find that early in life they reach their maximum and that their capacity is either station-

ary or has begun to decline at 35 or 40. This is true of all athletes, oarsmen, pedestrians, lumbermen, guides, farmers, and soldiers. Beard says: "To get the best soldiers we must rob neither the cradle nor the grave, but select from those decades when the best brain work of the world is done." It has been statistically determined by Sir Crichton Browne in England that among the handicrafts of weaving, button making, and pottery making there is an increase in proficiency from 17 to 30, when the maximum is attained. From 30 to 45 there is an equilibrium, and after that a gradual decline.

We are therefore strongly admonished that the most possible should be made of early life. Youth is the time of great opportunities which come but once. We build for eternity. The youth cannot sow wild oats and expect to reap a character of noble manhood and womanhood. "Whatsoever a man soweth that shall he also reap." Luther once said: "If a man is not handsome at 20, strong at 30, learned at 40, and rich at 50, he will never be handsome, strong, learned, or rich in the world."

XXVII

VOLITION AND MORAL EDUCATION

Meaning of Will.—Will is ordinarily spoken of as if it were an entity, a something which compels us to follow some line of action rather than another. It is said, for example: "He kept up by sheer force of his strong will," "His iron will carried him onward," or "His will weakened," "He failed because he lacked will," etc. One person is said to have a firm will and another one that is vacillating. Will is thus regarded as a sort of psychological ghost which continually pursues us compelling or prohibiting whatever we undertake to do. It is regarded as a transcendental something outside of the self and apparently not subject to the usual laws governing mental life. Every one is supposed to have a will of inherent and unmodifiable quantity and quality. Each is supposed to be ushered into the world with a particular species of will to be his life-long dictator.

A little reflection ought to convince us, however, that the will is not a separate and transcendental entity, but that all volition conforms to universal laws of psychic action. From previous discussions we have seen that one of the most fundamental conceptions of mental life is that of its unity. The mind is not a sum of separate faculties each of which functions independently of the others. There is no intellectual activity without some feeling-tone; there is no feeling without some accompanying knowledge. Likewise there is no such thing as pure volition without some feeling and some intellection. Why do we will? Because we desire something. Why do we desire it? Because we have knowledge of it, and it seems to possess some worth for us; because we have had experiences which have left tendencies

toward the particular action. We give it our attention which is the same thing as choosing or selecting it. I have emphasized this view-point because it is so important in considering will training to bear in mind the interrelation between these psychic activities. The will can no more be isolated for the purpose of training than we can isolate mind or body from each other. The will is the dynamic or active phase of any mental state. It always exists in concomitance with states of knowing and states of feeling. Cognitive experiences come to possess certain values for a given mind and it is said to have feelings or emotions. Because of the values attached (feelings, emotions), it strives to accomplish certain ends—actions, inhibitions, etc. (wills).

In this connection Royce writes that our minds are full of "passing impulses, of tendencies to action, of passions, and of concerns for what we take to be our welfare. All these impulses and concerns get woven, by the laws of habit, into systems of ruling motives which express themselves without in our regular fashions of conduct. The whole of our inner life, viewed in this aspect, appears as the *purposive side of our consciousness, or as the will in the wider sense.*" [1]

Genesis of a Voluntary Action.—In order to understand fully developed volitional acts let us examine the genesis of a voluntary act, for example, throwing at a mark. We throw at the mark and do not succeed. But in so doing we have gained certain experiences—muscular, auditory, etc. Each of these experiences leaves a memory. It may be a visual memory of the appearance of the mark and of the distance, or it may be the kinæsthetic memory of the position of the arm as it was raised, as the missile was hurled, of the position of the hand and the fingers as the missile was released, etc. All of these memories are taken account of in gauging the next trial. We know, for example, how wide of the mark we came and how much muscular tension was exerted, at what height the object was released. These memories we compare with our ideas of the amount of force that ought to be exerted, the modified positions to be taken

[1] Royce, *Outlines of Psychology*, p. 367.

by the arm and hand, and other conditions which we think ought to bring about the desired end. We try again and possibly err in the opposite direction. The memories of this experience are now compared with the former ones and also with the imagined necessary ones and we repeat the trial, trying to correct all the former errors. If perchance we have accidentally hit the mark the first time the case is fundamentally the same. In either case we try to remember the sensations and perceptions gained under these conditions and then endeavor to repeat them. It takes many trials before we can perform the action purposively, because our memories of the movement are so fleeting and imperfect, and our ideas of what is necessary are so indefinite. At first we can not know just what to do because we can have no accurate idea of the end until we have actually accomplished the end.

From this analysis we see that in order to perform an act voluntarily we must have (*a*) an idea (not necessarily a conscious idea) of the end to be accomplished, and (*b*) a stock of memories of former experiences from which a suitable selection can be used in guiding action toward the ideal end. This idea of the end to be accomplished includes not only an idea of what is to be done, but also the idea of how to do it. On first consideration this may seem a startling statement. The inquiry will at once be raised as to how we can ever perform an act voluntarily if we must first know definitely how to accomplish the act and if that knowledge can only be gained by actual performance of it. Paradoxical as it may seem, however, no act can be performed voluntarily until it has been first performed non-voluntarily. This does not mean that as a whole it must have been performed non-voluntarily, but that the elements which enter into it must have been performed non-voluntarily. In the case of reaching for a book, for example, we do it at once without difficulty although we have never reached for the identical book or in that particular place. But we have moved the arm and the hand in countless directions previously and each of these reachings has been recorded in memory. Now when we wish to reach for a particular

book in a particular place we select from all the past experiences certain elements and combine those elements into a new whole and perform the new action with ease.

James writes that "no creature not endowed with divinatory power can perform an act voluntarily the first time." But as we are not endowed with prophetic power we must wait for the movements to be performed involuntarily before we can frame ideas of what they are. "We learn all our possibilities by the way of experience. When a particular movement, having once occurred in a random, reflex, or involuntary way, has left an image of itself in the memory, then the movement can be desired again, proposed as an end, and deliberately willed. But it is impossible to see how it could be willed before. *A supply of ideas of the various movements that are possible left in the memory by experiences of their involuntary performance is thus the first prerequisite of the voluntary life.*"[1]

Professor Royce voices the same idea in the following sentences: "Strange as the statement may seem, *we can never consciously and directly will any really novel course of action. We can directly will an act only when we have before done that act, and have so experienced the nature of it.* The will is as dependent as the intellect upon our past experience. One can indeed will an act which is sure to involve, in a given environment, absolutely novel consequences; but the act itself, so far as one wills it, is a familiar act. Thus a suicide can will an act which results in his own death, and so far he seems to be willing something which wholly transcends his past experience. But, as a fact, the act itself which he makes the direct object of his will (*e. g.*, pointing a pistol and pulling a trigger, or swallowing a dose) is itself an act with which he is long since decidedly familiar."[2]

Fundamental Movements Involved in Volition.—All voluntary actions utilize the conserved effects of previous experiences—the organic motor memories, traces, or impulses. Every movement

[1] James, *Principles of Psychology*, II, pp. 487, 488.
[2] Royce, *op. cit.*, p. 369.

of the body, voluntary or non-voluntary, bequeaths some of these effects which are drawn upon in subsequent volitional activities. Consequently it becomes important to indicate specifically at least the main classes of fundamental muscular activities out of which the more complex stages of volition develop.

(1) From our discussion of self-activity we have seen that every organism tends to produce some movement merely through the processes of growth, those which are simply the result of an overflow of nervous energy. These movements are random and indefinite. These *spontaneous* movements are a direct function of nutrition. Warner says that "movement is the most obvious outcome of nutrition in a subject. A young infant is full of movement while awake if nutrition is good; its arms and fingers are moved apparently spontaneously."[1] (2) Through the various reflexes set up by external stimuli the babe performs many random movements. (3) Through instinctive movement produced by hunger much aimless moving about is carried on. (4) Through other instincts many active processes are set up, such as sucking movements, biting, grasping, winking, crying, smiling, babbling, creeping, etc. (5) Through being carried about, being fed, washed, dressed, etc., thousands of positions are assumed; *e. g.*, gravity causes the hands and feet to fall if unsupported. Thus many movements, accidental so far as the child is concerned, are experienced. (6) In attempting to perform some definite voluntary act we non-voluntarily, *i. e.*, unintentionally execute a multitude of other movements.

All of the foregoing and many others tend to form impulses toward reaction on receiving new stimuli. Thus vast numbers of will-less movements are executed and become a basis for the complex purposive intentional and controlled activities. The learning of any new movement, especially by the lower animals and by children, becomes a process of trial and error, a process of selection of appropriate movements from among the heterogeneous mass of remembered movements. Some writers go so

[1] Warner, *Physical Expression*, p. 59. See the chart showing tracings, p. 245

far as to say that normally all motor education and adjustment is a process of selection of suitable movements from among an excess of movements inherited by the child. There is thus a survival of the fittest in motor ideas.

Initial Stages of Volition.—The newborn babe has no will of a very high type. No movements or actions are consciously and deliberately attempted. However, through heredity and individual muscular development a large degree of muscular control has been attained. The child has power to move its limbs in a strong and vigorous way. This power is hereditary and not dependent upon the reflexes incident to growth and environment. Those due to early experience soon reinforce the instinctive ones. Many of the truly instinctive movements are under firm control. For example, though instinct prompts the sucking movements they are by no means automatic or reflex but well under control. If the child feels a bit of bare skin, as on the arm, its head begins to turn and its mouth to try to grasp. Instinct prompts to the action, but the control is volitional—elementary to be sure when compared with the will that builds railroads and moves armies, but volitional nevertheless. One child at birth kicked so and threw his arms about that a blanket was with difficulty kept about him. Newborn children can writhe about and twist their bodies, turn the head, and even raise the head considerably when laid on their faces. Again they have such power in their arms and hands that a pencil or a finger is at once grasped. On good authority we also know that many children can support their entire weight for some time if suspended from a stick which they have been given to grasp. This instinctive power soon fades away. While crying is at first entirely instinctive and reflex, the child with great precocity soon learns to control the voice for his own advantage. Facial expression, bodily movement, grasping, examining, locomotion, etc., all appear rapidly in the child's development. Even some control of attention appears remarkably early.

The Development of Voluntary Motor Ability.—The development of the will in the child is interesting to trace. Instead of

being a fixed quantity manifested on all occasions it grows gradually with the growth of the body, with the growth of the intellect and of the feelings. Hancock made a comparative study of the motor ability of children of various ages and of adults. He tested their powers of steadiness in standing, and in executing various movements such as threading needles and tying the two ends of a rope together. He tells us that in the tests for co-ordination of movements children experienced great difficulty in executing the finer ones. Fifty-six boys, ranging from five to seven years, were given extra large needles to thread. Fifty succeeded, but only after two or three efforts. It often made them nervous to try. Twenty-two children out of sixty-three were unable to tie the ends of a two-foot string together. All who succeeded did it in the most simple way possible, *viz.*, by placing the ends side by side. Children find it difficult to beat time because of lack of power of co-ordination.

Mr. G. E. Johnson made many tests of motor ability among idiots, and he found them very deficient in voluntary control, especially of the accessory muscles. Their movements are usually of a low order. He says: "No one who has ever seen a company of low-grade feeble-minded persons will ever forget the strange anomalies in their movements. The rolling head, the convulsive shiver, the contorted features, the strange postures of hand and body, the puzzling gesticulations, the rocking gait, leave an indelible impression even among all the other curious and at first deeply repulsive features presented by this unfortunate class."[1] "In some of the lowest cases there is found the most incessant motion. Many of these movements involve only the fundamental muscles of the trunk." He says that many sit and constantly rock back and forth. They often sit with their legs folded up under them.

In order to test the relation between voluntary motor control of the fundamental and the accessory muscles Mr. Johnson had them rotate the arm as rapidly as possible and also open and shut the fingers as rapidly as possible. He also tested normal

[1] "Feeble-Minded Children," *Ped. Sem.*, 3 : 274.

children in the same way for purposes of comparison. Some of his results are appended. The figures indicate the number of rotations of the shoulder which were made in ten seconds and the number of times the fingers were opened in the same length of time: [1]

	Av. Age	Shoulder	Fingers	Ratio
8 feeble-minded boys	13.6 yrs.	21.60	17.62	100 : 81
8 " " girls	16.1 "	21.25	20.25	100 : 93.2
13 normal boys	13.6 "	26.85	25.15	100 : 93.6
12 " men		25.40	32.70	100 : 128
5 " women		22.60	32	100 : 141

Johnson remarks that among the idiots there was almost no power of opening and shutting the fingers laterally. In attempting these movements oftentimes some more fundamental movements were first made. We know also that the associations of the feeble-minded are of a very low order and made very slowly. Associations which are made easily and quickly by normal children may be wholly beyond the power of the defective. Sense-perception and a low order of memory may be fairly developed, but higher associations are almost wholly lacking. Mr. Johnson tells us that frequently "The child who hears well, who sees well, who has good general sensibility and fair memory, as many of these children have, may show as his main defect inability to form associations." [2] Very simple games are required for "The co-ordination of muscular movements, the quickness of thought, the idealization necessary in many games of children, are far beyond a feeble-minded child."

"In the willed movements, the difference between the control of the fundamental and of the accessory muscles was much more marked in the feeble-minded than in normal children. This was the more noticeable the greater the degree of idiocy. Some who could execute gross movements with regularity and control

[1] *Op. cit.*, p. 281.

[2] *Op. cit.*, p. 284.

were wholly deficient in the execution of finer movements. Even those who walked strongly were utterly devoid of the grace which results from a well-developed sense of muscular co-ordination and control. Nothing is more striking than the clumsy awkwardness of idiots. Sometimes where the control of the fundamental had been nearly perfected, there seemed a positive gap, as if the accessory had not developed."[1]

What Is a Strong Will?—According to the popular notion that person has a strong will who is full of strong, uncontrolled impulses, who exhibits great vigor in doing things in the face of opposition, or who is able to resist great temptations. Our examination of the development of voluntary movements and the relation between volition and habit will not bear out the popular notion. The subject is so difficult, however, that a little closer examination is necessary for full understanding. A voluntary action is one that is under control. It is one which has been brought under control by the individual or it may be in part due to hereditary tendencies. Yet we say of the man who experienced a great temptation to go into the saloon, who had a tremendous struggle with himself against going, but who finally mastered his inclination, that he had a strong will. Another man goes by the saloon door with no temptation, no inclination to go in, and without any struggle. We give him no credit for strength of will. We demand that there be struggle in order to ascribe anything to strength of will. The man who goes about with no temptation to pick people's pockets, no craving for murder, no longing to set a match under his neighbor's house, no struggle against evil is not thought of as strong-willed. But let a man struggle with debasing impulses, coming out victorious, and we cite him as a man of will. Now, this is incorrect. We may laud the man who has struggled and won as a means of encouragement to future righteousness, but it is wrong to regard him as an exemplar of sturdy will. A strong will in the psychological sense means a trained will; it means a high degree of control: while the very fact that a struggle with temptation

[1] *Op. cit.*, p. 281.

has ensued indicates difficulty of control or lack of will. The temptation and the struggle are indications of disease of will or lack of perfect volitional development. The power to go by the saloon, to keep one's hands out of people's pockets, to inhibit thoughts of revenge and injury to others is a token of a high degree of will training. These virtues do not come merely through individual training, but they indicate hereditary tendencies accumulated through generations of training in temperate living, abstinence from excesses, self-renunciation, altruism, etc. Hence, the person with desirable hereditary endowment and properly developed individual habits does not feel temptation toward intemperate sense gratification, taking what does not belong to him, or destruction of another's property.

Most people would grant that I am *voluntarily* writing these words, but how many there are who would not admit that such action exhibits considerable will power. Should I walk across the floor or open my mouth and speak several sentences correctly few would deny that it was voluntarily done, but how many would fail to acknowledge that it was an exhibition of strength of will. Because of the looseness of popular psychological analysis and the inaccuracies in the use of language the word *willingly* has not been generally thought to express an attitude of *will.* But in reality one who is willing in doing a thing wills to do it. Should I be stricken with palsy and then tremblingly write a page, or stammer out a few incoherent sentences, or walk with tottering steps across the floor, but exhibit struggle and persistence, the same ones who conceded nothing to my will before, would now marvel at my strength of will. As I regard the case, the palsied nerves, the exhausting struggle, and the indifferent execution are all signs of diseased and therefore weak will. The perfect control without struggle, and accurate execution are evidences of strength of will in that direction. Whatever is voluntarily done and with ease and accuracy is a manifestation of a strong will.

Individual Variations in Volition.—It will readily be noted that there are a great many varieties of volitional response

manifested by different individuals. There is the person who is cool, calm, calculating, and deliberate in everything he does; as his opposite there is the one who always acts on momentary impulses, never foreseeing completely the results of his action. Among the former type, represented admirably by Gladstone, are the great constructive statesmen; in the latter class we find many great reformers and soldiers—such men as Luther and Napoleon (the world-shaking type, as James denominates them). Then there is the vacillating type, thoroughly deliberating and weighing, but never arriving at a decision. Such a one is always "going to do" something, but never getting started. Extremes of this type, of course, are pathological.

It should also be noted that the same person may have strength of will in one direction and not in another. A highwayman may give an exhibition of the most perfect control in a railway holdup, but be the most weak-kneed coward imaginable in facing a drawing-room full of company, in making a speech, or standing firm in a moral issue. Stammering is a disease of the will, and who has not seen otherwise strong men who have been stammerers? The stammering was indicative of weakness in a single direction. One may have perfect physical control, but be lacking in intellectual control, *i. e.*, he may be subject to mind wandering, lacking in attention, in control of memory, imagination, thinking, etc. One may have good control of predominantly intellectual processes but be without proper emotional balance. He may be a slave to some great absorbing passions or may be subject to explosions of temper. Similarly there are those who have perfect control of intellectual and emotional processes but who are sadly lacking in moral control. It is important in education to recognize these variations that may appear in the same individual. If the moral will is weak, for example, it is frequently impossible to develop it through purely intellectual activities. Logical training will not necessarily produce honesty.

Will Means Accumulated Tendencies.—I have tried throughout this work to indicate that every experience leaves its inef-

faceable trace upon the nervous system and consequently upon the mind. As these effects of experience accumulate in certain directions, impulses and tendencies toward action are produced in those directions. In this way the mind and body develop particular attitudes and processes. When we analyze the meaning of character we find that it implies nothing more nor less than the accumulated tendencies toward action in particular directions. A man who has habitually acted in a righteous direction has built up tendencies toward righteousness. On the other hand, one who has sown a generous supply of wild oats in youth is sure to reap in old age an abundant harvest of viciousness. It could not be otherwise. We are enjoined in the Scriptures that "whatsoever a man soweth, that shall he also reap." It may seem somewhat materialistic to call these results of experience character, but from a scientific analysis of the effect of experience upon the nervous system and upon the mind we cannot help but conclude that character is a result of all the experiences which have come to us. It is somewhat annoying to the one who has led an idle, dissolute life to contemplate that the record of all his life is constantly in evidence in impelling him in the direction in which he has started, but the result is unavoidable. On the other hand, one may derive a large measure of comfort and satisfaction from a knowledge of the scientific fact that life-long experience in the direction of right will produce a fund of capital upon which we are continually to draw. A man who has thus lived properly all his life will be able to stand firm easily when the storm of temptation rages round him.

Relation to "Free-Will."—Viewed from this stand-point, we may be accused of refuting the doctrine of free-will, which we are really espousing. This doctrine, however, as often stated, is a mere quibble of words, and many of those who think they believe in the doctrine of free-will do not have an adequate comprehension of its consequences. Ordinarily the uncritical individual regards himself as a free being who may do whatever comes into his mind. He says, "I am free to do what I please."

Should we analyze the case in the light of the foregoing conception of will and its development we should probably see that no individual is absolutely free to do what he may happen to think. In a way he may perhaps do what he pleases, but he is not free to be pleased to do whatever he may think or whatever may be suggested to him. He who has lived a life of righteousness is not free to be pleased with doing vicious things. Moreover, to a large extent, such a man is never free to do those things which are evil. During his whole life he has been forming habits in a different direction and these developed tendencies bind him almost surely to perform actions which are in harmony with them. We are continually chained to a certain extent to a routine life because of the force of habits which have become ingrained in us. Not only are our physical habits binding, but all our mental habits are equally enslaving. It is exceedingly difficult, as every one knows, for us to initiate entirely new and unfamiliar lines of activity. We are not free to think as we please, but we are bound to think along the lines of our previous thinking. In the words of Dr. G. Stanley Hall: "We will with all that we have willed." Furthermore, every time that we think, we will.

I have frequently said to students: "You may think you are free to do anything that you know of or understand and which is not beyond your ordinary powers of execution, but an illustration will easily convince you that such is not the case. For example, when you go to church on Sunday you would not be able in the middle of the sermon to stand up and whistle or swear or give the university yell. Now, physically, it is perfectly possible for you to do those things, and under other conditions you would be able to execute them; but under the conditions imposed you would be absolutely bound down to another course. All your ideas and habits and mental traditions are against any such extraordinary conduct, and hence while in church you must act according to your habitual ways of thinking and according to the traditions of the house of worship which fill and take possession of your subconsciousness. No

matter how great a sum one would promise to you if you would do those extraordinary things you would be utterly unable to do them. In other words, you are free only in the direction in which your past life allows you to act. You are absolutely prohibited from doing those and thousands of other things." Again, as an illustration of the same point, I say to them: "I had an appointment to speak before you to-day at ten o'clock. The weather was cold and stormy and everything exceedingly disagreeable and uninviting outside. It would have been a great pleasure for me to remain by my own fireside and bask in the warmth of the furnace heat, but throughout my whole life I have been accustomed to meeting all my appointments and on this occasion I should be utterly unable to remain contentedly by my fireside and break my engagement." In a sense I was not free to act according to my momentary inclination. I was impelled to act in the direction which the habits of my whole life have determined for me.

During my whole career I have tried to lead an upright life and I contend that it would be utterly impossible for me to raise my hand against my neighbor in the act of murder. I am pleased to think that my whole previous career would act as a source of inhibition of any such procedure. But the criminal who has long schooled himself in vice would not feel this restraining influence. Gradually he has developed impulses and tendencies which would lead him in the direction of crime, and now upon the slightest provocation those impulses develop into corresponding actions. Hence we see from the pedagogical point of view how important it is to fortify the child against that which is undesirable in conduct by developing in him worthy impulses and tendencies through experience in right conduct. Right conduct in childhood there must be if we expect right conduct in adult years, and the only freedom which the man can ever have to do those things which are righteous and just is that freedom which is developed through life-long habits of righteous conduct. Otherwise all one's previous life in the opposite direction is ever present tending to drag one down.

In support of this point of view I append some words from Professor Fullerton who has made one of the clearest and most rational expositions of the doctrine of free will ever set forth. He writes as follows:[1]

"For forty years I have lived quietly and in obedience to law. I am regarded as a decent citizen, and one who can be counted upon not to rob his neighbor, or wave the red flag of the anarchist. I have grown gradually to be a character of such and such a kind; I am fairly familiar with my impulses and aspirations; I hope to carry out plans extending over a good many years in the future. Is it this *I* with whom I have lived in the past, and whom I think I know, that will elect for me whether I shall carry out plans or break them, be consistent or inconsistent, love or hate, be virtuous or betake myself to crime? Alas! I am 'free,' and this *I* with whom I am familiar cannot condition the future. But I will make the most serious of resolves, bind myself with the holiest of promises! To what end? How can any resolve be a cause of causeless actions, or any promise clip the erratic wing of 'free-will'? In so far as I am 'free' the future is a wall of darkness. One cannot even say with the Moslem: 'What shall be, will be'; for there is no shall about it. It is wholly impossible for me to guess what I will 'freely' do, and it is impossible for me to make any provision against the consequences of 'free' acts of the most deplorable sort. A knowledge of my own character in the past brings with it neither hope nor consolation. My 'freedom' is just as 'free' as that of the man who was hanged last week. It is not conditioned by my character. If he could 'freely' commit murder, so can I. But I never dreamt of killing a man, and would not do it for the world! No; that is true; the *I* that I know rebels against the thought. Yet to admit that this *I* can prevent it is to become a determinist. If I am 'free' I cannot seek this city of refuge. Is 'freedom' a thing that can be inherited as a bodily or mental constitution? Can it be repressed by a course of education, or laid in chains by life-long habit?

[1] "Freedom and 'Free-Will,'" *Popular Science Monthly*, 58 : 189, 191.

In so far as any action is 'free,' what I have been, what I am, what I have always done or striven to do, what I most earnestly wish or resolve to do at the present moment—these things can have no more to do with its future realization than if they had no existence. If, then, I really am 'free,' I must face the possibility that I may at any moment do anything that any man can 'freely' do. The possibility is a hideous one; and surely even the most ardent 'free-willist' will, when he contemplates it frankly, excuse me for hoping that, if I am 'free,' I am at least not very 'free,' and that I may reasonably expect to find some degree of consistency in my life and actions. An excess of such 'freedom' is indistinguishable from the most abject slavery to lawless caprice. . . .

"It is a melancholy world, this world of 'freedom.' In it no man can count upon himself and no man can persuade his neighbor. We are, it is true, powerless to lead one another into evil; but we are also powerless to influence one another for good. It is a lonely world, in which each man is cut off from the great whole and given a lawless little world all to himself. And it is an uncertain world, a world in which a knowledge of the past casts no ray into the darkness of the future. To-morrow I am to face nearly a hundred students in logic. It is a new class, and I know little about its members save that they are students. I have assumed that they will act as students usually act, and that I shall escape with my life. But if they are endowed with 'free-will,' what may I not expect? What does 'free-will' care for the terrors of the Dean's office, the long green table, and the Committee of Discipline? Is it interested in Logic? Or does it have a personal respect for me? The picture is a harrowing one, and I drop the curtain upon it."

Professor Paulsen shows that freedom of will is not an original endowment of human nature, but an acquired characteristic. One cannot necessarily accomplish every individual thing which one may wish, but by persistent effort one can determine the whole course of his life in consonance with an ideal standard

chosen. He says that freedom "has been acquired by the entire race in the course of history, and must be acquired anew by each individual. The new-born child does not bring with it a ready-made freedom; nay, it is driven like an animal by momentary cravings. But gradually the rational will, supported by education, rises above the animal impulses. This occurs in a different degree in different individuals; some are wholly controlled by these impulses during their entire lives, others acquire such a remarkable control over nature in themselves that they seem to regulate even the smallest details of their lives by rational deliberation, and never do anything or leave anything undone, except by choice. It is to be observed, in this connection, that though it is vulgar and base to give the impulses complete mastery over one's self (*ἀκολασια*), yet the complete suppression of them fills us with fear and awe; no one, as has been said, is lovable without his weaknesses. Man seems to be intended as a mean between an animal and a purely rational being.

"Hence, can man determine himself by his own will? Can he fashion his will by means of his will? Yes and no. Yes, for he undoubtedly has the faculty of educating himself; he can fashion his outer and inner man, with conscious purpose, according to his ideal; he can discipline his natural impulses, nay, even suppress them so that they will no longer move him. To be sure, he cannot do this simply by wishing or resolving it; he can do it only by constant practice and by employing appropriate means, in the same way that he acquires bodily skill. We cannot when awake immediately force ourselves to sleep, by an act of the will; but we can, by proper diet and work, exercise such an influence upon the body that sleep will come in time of its own accord. It is said that Demosthenes's pronunciation was naturally indistinct and defective; the will to be an orator was not able, *per se*, to coerce the organs of speech, but it was able to prescribe to nature long and arduous tasks and to make these serve the desired end. Inner nature is susceptible of being influenced in the same way. A man

knows that he has a dangerous tendency to anger. He decides to overcome it. His prudence and his good resolutions alone cannot, of course, by their mere presence, repress the violent fit of temper the very first time it breaks out again. But they can take the proper precautions necessary to subdue it gradually. They determine him to avoid temptation; every organ, however, that is not exercised decays. His mind is filled with examples of the injurious effects of anger as well as with examples of self-control; he even makes use of trivial aids; we accustom ourselves to say a prayer or to recite a few verses when we are seized with anger. Hence, a man can unquestionably transform his nature by his will. He may by inhibiting certain impulses destroy them, and develop and strengthen weak impulses by habit. 'Habit,' says the proverb, 'is second nature.'" [1]

Educational Significance.—This conception of the will, which is just beginning to be recognized, is of great importance pedagogically. Under the old way of conceiving the will as an entity of predetermined character, it was certainly useless to try to cultivate it, though, paradoxically, the same writers who promulgated the older theories of will and freedom of the will discoursed upon the great possibilities of will development. According to the view that will always implies conscious choice and deliberation there could be no training in volitional activities until there had been developed a high degree of intellectual and affective life. There could be little, if any, manifestation of will in animals, and none in children until some months old. There could certainly be no use trying to train the will of a small babe, for children are many months old before they deliberately choose and execute. The same criticism applies here as upon all of that psychology in which every psychosis was viewed from the stand-point of adult consciousness. The more recent psychology considers everything genetically and finds a rich heritage in the hereditary accumulations and in the subconscious life of both babyhood and of normal adult life. There is a rich mine of experience gained before the dawning

[1] Paulsen, *A System of Ethics*, translated by Thilly, p. 469.

of consciousness which must be explored and which makes up a worthy portion of all our tendencies. We have learned through the study of memory and instinct that every impression leaves its ineffaceable trace. Thus every infantile kick and howl and tumble become significant for the larger development of voluntary life. We have seen that we will with all that we have willed. To will in absolutely novel directions is as impossible as lifting one's self by the boot straps. The execution of every movement becomes significant. Hence it becomes important to regulate this congeries of random movements producing orderly paths of execution. Thus when we train the child to eat regularly, to sleep at definite times and quietly, when we promote digestion, when we care for its physical health and keep its motor apparatus in working order, we are helping him to lay the desirable foundations of his voluntary life.

Directions of Control.—Among the manifold directions of controlled actions only a few may be discussed, and these merely in a suggestive, rather than an exhaustive, manner. First and fundamentally every child must acquire muscular control of a great variety of actions and in some cases of exceeding complexity. What are creeping, walking, standing, running, feeding one's self, going through the process of dressing, etc., but cases of voluntary control? True they come to seem automatic, but they are directly subject to modification and control and therefore volitional. To stand well, possess an erect carriage, walk gracefully, manage one's hands and feet without awkwardness, etc., are no mean accomplishments. They often secure for one an entrée to the best society and even add to one's monthly salary. To give assurance of possessing these qualities is a prime endorsement to a candidate for many positions. They must be learned, too, contrary to current opinion. They are a badge of good society, and indicate that the possessor of these habits has been under approved tutors, unconsciously observed it may be, but none the less important. To manage one's voice so as to utter words distinctly, without stammering or hesitation, to modulate the voice properly in

talking and singing, to be able to marshal apt words readily, to have the power of speaking in different languages; all these are excellent cases of a high degree of control. Who will say that they are not voluntary? Still there is no great degree of control until they are largely habitual. These are all worthy directions of will training. Proficiency in any of the several directions indicates education of the highest importance and gained only through much practice. Not only are the foregoing examples of muscular co-ordination and control, but they also illustrate controlled, highly complex psychical activities. Such activities as are manifested in drawing, painting, sculpture, watch-making, the fine touch and execution in surgery, or playing the piano or violin, are all splendid illustrations of a high degree of co-ordination and control.

It is highly important that children receive thorough muscular training. This training in voluntary motor ability should be begun in infancy. The child must be allowed to move about freely. We have by no means reached the acme of perfection in the matter of suitable clothing for babies. At the outset we put them in dresses long enough to suit a ball-room belle. Instead of being able to kick about vigorously they are hampered in their movements by the unhygienic clothing. When the child becomes old enough to creep he is often prevented by the mother who fears he will soil a pretty dress. He is thus deprived of lung development, chest expansion, control of hands, arms, and feet, and, in fact, the entire body is deprived of normal development. One child studied, who had been deprived of the pleasure and profit of creeping, was put into "jumper overalls" and allowed to creep. He gained two inches in chest expansion in eleven days! Besides the improvements in vital capacity and increased chest measurement the child who creeps gains wonderfully in motor control. In his peregrinations he reaches for things, closes his chubby fists upon them, pulls himself toward things, making numberless daily motor adjustments requiring the fine calculation of conditions and the co-ordination of muscular effort. Again when the child loses his

provinciality and becomes a pedestrian, fashion steps in to forbid his wearing clothes in which he may sample sand piles and mud pies, in which he may climb fences and trees, turn somersaults or roll in the grass. When shall we learn that the child must have freedom in order to develop properly physically, mentally, and morally?

The games and plays of childhood not only develop muscular control—the elemental type of will—but through them the child also learns to direct thoughts to definite ends and to control his feelings, both through subordination and in proper assertion. Plays and games have not been sufficiently utilized as educative means. Their value has been demonstrated in kindergartens and in schools for the feeble-minded, and we should take a hint for the education of normal children. I hope the time will come when every teacher in our public schools will be required to be on the playground during certain specific times as a director of the play activities of the children.

Motor-Culture and Moral Culture.—Dr. G. Stanley Hall in his incomparable article on moral education and will training, points out the immense rôle motor training has occupied in will growth. He believes that city children of to-day are liable to deteriorate volitionally largely because they do not have opportunity for will-culture through motor-culture. By contrast he pictures the opportunities for such culture afforded by conditions of life a generation or two ago. In those days "most school-boys had either farm-work, chores, errands, jobs self-imposed or required by less tender parents; they *made* things, either toys or tools, out of school. Most school-girls did housework, more or less of which is, like farm-work, perhaps the most varied and salutary as well as most venerable of all schools for the youthful body and mind. They undertook extensive works of embroidery, bed-quilting, knitting, sewing, mending, if not cleaning, and even spinning and weaving their own or others' clothing, and cared for the younger children. The wealthier devised or imposed tasks for will-culture, as the German crown-prince has his children taught a trade as part

of their education. Ten days at the hoe-handle, axe, or pitchfork, said an eminent educator lately in substance, with no new impression from without, and one constant and only duty, is a schooling in perseverance and sustained effort, such as few boys now get in any shape." [1]

Children should be taught to work. A child that has not learned to work has not mastered the A B C's of will-training. Work differs from play in that it is not a means of relaxation. Work often demands that activity be kept up long after exhilaration has ceased. An object must be accomplished no matter what the inclinations may dictate.

Intellectual Control.—Although the foregoing activities involve controlled psychical processes, there are still higher mental activities which are not so closely related to muscular actions. What one thinks about when not engaged in set routine duties seems at first sight to be accidental and uncontrolled, but an examination will reveal that our thoughts lie along certain quite well-defined paths. We are constantly thinking about our line of work or pleasure, and, though temporary deviations are made because of chance suggestions, we continually revert to the habitual line of thought. It is precisely because the ideas are habitual that they are intruded before us. If we conscientiously set ourselves to reflecting upon a given topic the degree of habituation in that direction determines the degree of readiness with which we stick to the purpose. In other words, the more we know in a given line, the more we have thought about it, the greater the degree of thought-control we can manifest in that line. If I am able to secure willing attention from my class it is because the ideas which I am trying to get before them are so closely related to what they already know. If asked why they paid such close attention they would say because they were interested. This is only another way of saying that the road is a familiar one, that their apperception enables them to understand and follow without apparent effort what is discussed. Attention, even the most consciously voluntary, de-

[1] *Pedagogical Seminary*, 2 : 73–74.

pends upon points of relation between the thing attended to and the experience of the learner. No one can voluntarily attend for any length of time to a mere spot on the wall. It is meaningless and without interest. As soon as the mind finds no well-worn tracks to follow interest dies out, attention wavers, and control of thoughts is lost. The highest degree of volition is evidenced by long-continued application to a single purpose. The development of a great industry in pursuance of chosen ideals, the unremitting toil necessitated in writing books, or in patiently conducting experimental researches, the persistence often manifested in acquiring a college education unaided and in the face of obstacles, each exemplifies a superlative exhibition of protracted volitional control. The momentary control of anger under provocation, individual acts of bravery or self-denial, or the careful attention to a single lesson are not to be compared with the thoroughly established, consistent conduct, regulated in a thousand ways and all promoting a single end. The former actions represent merely temporary impulse, while the last named represents integrity and fixity of high moral character.

Some people frequently notice that they do not seem to keep their attention easily upon a given train of thought. They are subject to mind-wandering. They should be assured that this is largely because they have never developed habits of reflecting long and continuously about anything. The habit of looking at all sides of a subject can be developed by persistent practice. Frequently the mind wanders because no fund of knowledge has been acquired along the line of pursuit. Furthermore, the most willing attention, *i. e.*, the most voluntary attention, is a direct outgrowth of interest. Genuine interest can only be developed through previous knowledge.

A characteristic of children is that they live in the present and for the present. Ask a child which he would prefer, a stick of candy to-day or ten sticks to-morrow, and he will invariably choose the one to-day. Likewise the savage is largely unmindful of the future. He provides for the present meal and

then sleeps until hunger sends him on the chase to provide another. Civilization teaches men to deal in futures, to provide for the morrow, the rainy day, to provide a protracted course of education for the child as a preparation for the future. To teach the child to build for the future, to practise virtues and inhibit vices in order to eventually acquire ideal habits and states, and to insure the highest prudential control, is true pedagogy. The world's great thinkers have all been men who have been able to give sustained, undivided, and continuous thought to whatever occupied their attention.

Emotional Control.—To develop control of the feelings and emotions is an important direction of will-culture. When we consider that feelings and emotions are the great determining forces in active life and that no progress was ever made that did not have back of it a great interest, the importance of the question is impressed upon us. Our attitude toward life and its duties determines what our active relations will be. Are we happy, cheerful, full of sympathy and kindly fellow-feeling; or are we sorrowful, depressed, full of anger, jealousy, or resentment? The answer indicates the direction which our actions will take. Hence we see the importance in a child's education of teaching control of the emotions. In the early life of the infant, and to a considerable extent through childhood, the feelings are more dominant than the intellect. The feelings are much more paleopsychic than is the intellect. The majority of all free activities of the lower animals and of children are impelled by feeling. Hunger and its satisfaction, the use of the muscles in free play, satisfaction of curiosity, etc., are preeminently matters of feeling. (There are those who go so far as to say that the whole course of evolution is determined by pleasures and pains.)

Practically all the early manifested instincts are emotional. Among these are fear, anger, jealousy, shyness, sociability, affection, and curiosity. The whole natural psychical provision for self-preservation is largely a matter of instinctive personal feeling. Rational intellectual processes scarcely enter into

primitive modes of self-preservation. The newly-hatched partridge is terrorized by strange objects, it knows not why; the kitten spits at a dog simply because it possesses an antipathy against it, not because it has individually concluded that such a course is best.

Dr. Hall, who has emphasized so strongly the preponderant place which the emotions occupy in primitive life and in child-life, writes that[1] "Happily for our craft, the child and youth appear at the truly psychological moment, freighted, as they are, body and soul, with reminiscences of what we were fast losing. They are abandoned to joy, grief, passion, fear, and rage. They are bashful, show off, weep, laugh, desire, are curious, eager, regret, and swell with passion, not knowing that these last two are especially outlawed by our guild. There is color in their souls, brilliant, livid, loud. Their hearts are yet young, fresh, and in the golden age. Despite our lessening fecundity, our over-schooling, 'city-fication,' and spoiling, the affectations we instil and the repressions we practise, they are still the light and hope of the world especially to us, who would know more of the soul of man and would penetrate to its deeper strata and study its origins." He further says of the feeling-instincts that "These radicals of man's psychic life, while some of them are decadent, rudimentary, and superseded, are often important just in proportion to the depth of the phylogenetic strata into which they strike their roots. Hunger, love, pride, and many other instinctive feelings, to say nothing of pleasure and pain, can be traced far down through the scale of vertebrate and to invertebrate life."

The child must acquire control of the various emotions to the end that they may become his ally instead of his enemy. In the earliest days control of such low feelings as hunger through the habits of regular eating are installed. The regulation of this feeling is of life-long importance to every individual. Undoubtedly lack of control caused by irregular hours of eating, gormandizing in response to sense-feelings and improper food, have

[1] *Adolescence*, II, p. 60.

led in later years to intemperance in many other forms. Intemperance in eating, drinking, smoking, drug-using, etc., usually result from pampered, unregulated appetites.

The impulse to anger is early evinced. While contending for the high moral value of trained, intelligent anger, as evidenced by voting against chicanery and evil, yet we should teach that childish passion must be curbed. The infant straightens out, becomes tense, clutches its fists, screams, and abandons itself wholly to the feelings, partly of satisfaction, partly of anger or fear. Not only are no habits of self-control thus initiated, but positive habits of giving way to anger are developed. The man who gives way to anger, becomes dominated by animal manifestations, is always at a disadvantage with an adversary who keeps his head, who uses anger only to stimulate righteous action. Two general conditions must be observed in developing control of anger; first the child must be removed as far as possible from irritating causes; second, correlatively, he must be kept as good-tempered as possible. One attempt at forming habits of good-nature is worth ten efforts at reforming habits of ill-nature. Good health, proper hygiene, and sunny-tempered parents, teachers, and companions go far toward insuring even-tempered children; while a child who is forced to live with crotchety, moody, and cranky parents and associates, easily becomes inoculated with touchiness, irritability, and flightiness.

Because of the effect of assuming the outward expression of emotions in producing or increasing the emotion, it is highly valuable to the child to refrain from outbursts of temper, from giving way to foolish fears, or even to silly, causeless giggling. The conscious attempt to preserve a proper demeanor has a salutary effect in producing habits of emotional control. The hysterical, flighty woman, ready to go into spasms on hearing of a worm, a bug, or a fire; who throws a whole company into a panic in a time of excitement, is the one who was never taught to exercise proper self-restraint as a child. The cool, "heady" individual who averts panics, calms the crowd at a fire, or goes tranquilly into battle is the one who has schooled

himself from childhood against such impulsive outbursts of emotion. The freedom of the moment has been bought by life-long discipline.

Supreme wisdom is needed for developing well-regulated, healthful sex feelings. They are among the most deep-seated and far-reaching. Through the maintenance of perfect health, the restriction of food and appetites, proper exercise, healthy interests which monopolize the mental life, by giving plenty of physical work and wise companionship, sex feelings should become irradiated into the higher emotions connected with home-building, social interests, and altruism in general. Just how to secure this ideal is not easy to prescribe. It is worthy of the wisdom of the sages. Thus far the primer of the subject has not been formulated.

Drudgery and Moral Development.—James has said that to train the will we should do something frequently that is disagreeable, something for no other reason than that we would rather not do it. It is true that one should learn not to shirk duty, but he should also early learn to shoulder responsibility. A better dictum than James's would be, "Learn to make every duty a pleasure. Throw yourself into your work in such a way that a white heat of interest is maintained in it." Possibly not all details will prove entrancing, but interest in the ultimate end should ease the momentary difficulties encountered. We need not search for difficulties and drudgery. They will appear in sufficient numbers. A false pedagogy has assumed that some subjects are better than others because they are more difficult and require more drudgery. Anything that produces a feeling of drudgery, which is only another way of saying repugnance, can scarcely commend itself as a means of developing moral power.

Ideals, Expression, and Moral Growth.—James emphasizes the necessity of acting upon every emotion unless vacillation and weakness of will are to result. He italicizes the following maxim: "Seize the very first possible opportunity to act on every resolution you make, and on every emotional prompting you

may experience in the direction of the habits you aspire to gain." He says: "It is not in the moment of their forming, but in the moment of their producing *motor effects*, that resolves and aspirations communicate the new 'set' to the brain. . . . Every time a resolve or a fine glow of feeling evaporates without bearing practical fruit is worse than a chance lost; it works so as positively to hinder future resolutions and emotions from taking the normal path of discharge."

While I cannot coincide with this extreme opinion yet there is much truth in it. Considered in its extreme position it would be better not to read a book, to go to church or to the theatre, or to put one's self in the company of teachers who would stimulate high ideals. This I cannot believe. Even though one may not act immediately upon an emotional impulse the combined effects of all such emotions produce an attitude of mind which finally causes many acts in consonance with the emotions cherished. The theories of the conservation of forces, apperception, of ideo-motor action all lead us to believe that effects are cumulative and finally induce, directly or indirectly, multitudes of actions. The prose-poet has truthfully written, in substance: "Sow a thought and reap an act; sow an act and reap a habit; sow a habit and reap a character; sow a character and reap a destiny."

But, on the whole, James is right. Ideals actualized in motor consequents make the most lasting effects. So thoroughly am I in accord with the spirit of his main thesis, that after inserting the foregoing qualifications, I quote with approval the entire paragraph apropos of this maxim: "No matter how full a reservoir of *maxims* one may possess, and no matter how good one's *sentiments* may be, if one have not taken advantage of every concrete opportunity to *act*, one's character may remain entirely unaffected for the better. With mere good intentions, hell is proverbially paved. And this is an obvious consequence of the principles we have laid down. A 'character,' as J. S. Mill says, 'is a completely fashioned will'; and a will, in the sense in which he means it, is an aggregate of tendencies to

act in a firm and prompt and definite way upon all the principal emergencies of life. A tendency to act only becomes effectively ingrained in us in proportion to the uninterrupted frequency with which the actions actually occur, and the brain 'grows' to their use. . . . There is no more contemptible type of human character than that of the nerveless sentimentalist and dreamer, who spends his life in a weltering sea of sensibility and emotion, but who never does a manly concrete deed. Rousseau, inflaming all the mothers of France, by his eloquence, to follow Nature and nurse their babies themselves, while he sends his own children to the foundling hospital, is the classical example of what I mean. But every one of us in his measure, whenever, after glowing for an abstractly formulated Good, he practically ignores some actual case, among the squalid 'other particulars' of which that same Good lurks disguised, treads straight on Rousseau's path. All Goods are disguised by the vulgarity of their concomitants, in this work-a-day world; but woe to him who can only recognize them when he thinks them in their pure and abstract form! The habit of excessive novel-reading and theatre-going will produce true monsters in this line. The weeping of a Russian lady over the fictitious personages in the play, while her coachman is freezing to death on his seat outside, is the sort of thing that everywhere happens on a less glaring scale. Even the habit of excessive indulgence in music, for those who are neither performers themselves nor musically gifted enough to take it in a purely intellectual way, has probably a relaxing effect upon the character. One becomes filled with emotions which habitually pass without prompting to any deed, and so the inertly sentimental condition is kept up. The remedy would be, never to suffer one's self to have an emotion at a concert, without expressing it afterward in *some* active way. Let the expression be the least thing in the world—speaking genially to one's aunt, or giving up one's seat in a horse-car, if nothing more heroic offers—but let it not fail to take place." [1]

[1] *Principles of Psychology*, I, p. 125.

Will and Deliberation.—Although it has been strongly argued that the voluntary execution of an act is largely conditioned upon the fund of allied habits which have been built up, yet it should be noted that the highest acts of will involve conscious deliberation. While it has been strongly urged that the surest way of developing strength of will in a given direction is to early inculcate habits in that direction, yet this should not be taken to mean that one is to become an automaton. It does not imply that the child should not become a reflective being. He should most certainly be early accustomed to reflecting upon his conduct. A feeling of responsibility for sound judgment and righteous action should early gradually become characteristics of one's life. It is a perverted and pernicious doctrine of interest and will which assumes that youth are irresponsible beings who may be excused for every deviation from the path of rectitude on the ground that they are only youth. The doctrine is sometimes carried so far as to exonerate even university students for committing things which would land other adults in the penitentiary. Though college education should and does prolong the period of infancy or plasticity, yet all training has been misdirected if it has not developed a habit of serious reflection upon every important step to be taken. It should not produce vacillation and hesitation, but rather sound judgment made rapid by the acquired habit of always reflecting and marshalling all sides of a question. Individual duty and responsibility are among the highest lessons to be learned and the most difficult.

Habit, Will, and Character.—A trained will means a controlled mind and body, an organism that responds to the behests of conscience. This ideal condition can only be secured through oft-repeated actions in the desired direction. Every action performed by a child, whether initiated by himself or under compulsion, leaves a tendency to a repetition of the same action. Of course any process self-initiated is more potent by far than one performed under compulsion. Hence the importance of securing deliberate righteous action on the part of the

child. But right conduct, even though compulsory, is better for the child's future than wrong conduct selected by the child. Every righteous action contributes to the fund of future capital which constitutes real character. What one does in a controlled manner when off his guard reveals one's real character. To be sure most of us masquerade a great deal and do many things that are put on for the occasion. These may give us reputation, but they are not parts of real character. It is related by Schaeffer[1] that the Pennsylvania German gives vent to his feelings in profanity in his own native dialect. To show further how control is only secured through habitual reactions he adds that, "As soon as he says his prayers he reverts to the language of the pulpit and of Luther's Bible because he there finds the words which express the deepest wants and emotions of the human soul."

[1] *Thinking and Learning to Think*, p. 93.

CHAPTER XXVIII

GENERAL DISCIPLINE AND EDUCATIONAL VALUES

Meaning of General Discipline.—How do the various special educational activities which a child undergoes affect his general powers? This is a question of vital importance in determining educational practice. The popular mind has always had a ready reply. The answer is substantially that exercise is the *sine qua non* of growth, and the further assumption is made that the effects produced are not confined to the special organs or powers involved. It is held that the effects of training are general and that whatever is gained by any organ or power through a given kind of activity will increase the efficiency of all other organs or powers and can be utilized in all other situations in life. The strength and skill derived through pitching hay, swinging Indian clubs, and rowing, for example, can be used in skating, swimming, constructing watches, or in resisting fatigue when under strain in professional duties.

Analogous reasonings are followed out concerning mental growth and exercise. Each subject is assumed to be a sort of mental grindstone upon which the wits are sharpened. We are told that the study of arithmetic, grammar, etc., will develop general strength of mind—a sort of mental muscle—which can be drawn upon in any emergency. It is assumed that the one who is strong in arithmetic will be equally proficient in geometry, botany, or foreign languages, because of the power gained through the exercise in arithmetic. The traditional subject most recommended for strengthening the reasoning powers is arithmetic. Robert Recorde was the author of a book on algebra published in 1557, called *The Whetstone of Witte*, evidently because he regarded it as a sovereign means of sharpen-

ing the faculties. Nature study is supposed to train "the power of observation," and grammar has maintained its place largely because of its general "disciplinary" value. It is said to develop keenness of perception, to strengthen the memory, make one logical, give one insight, etc., etc. While some argue the superior efficacy of this or that subject, there is a prevailing impression, even among many teachers, that it does not matter very much what one studies provided it is difficult. The exercise required by hard work and the "discipline" resulting therefrom are the chief considerations. The *how* is thought to be a much more important consideration than the *what*.

The exponent of general discipline speaks, for example, of training the senses, meaning thereby the exercise of seeing, hearing, or touching for the sake of the exercise alone. What is seen, heard, or touched is regarded as of minor consequence. The exercise is considered the important thing. By the process the senses are supposed to have taken on additional power so that they may see, hear, or touch anything and everything the better. Primary teachers often give exercises in what they term "sense training." It consists in presenting various colors, forms, and objects to be seen and identified, sounds to be heard and remembered or reproduced, various muscular activities to be witnessed and reproduced, etc. By this means it is supposed that the senses are "trained" for any situation in life. The exercises are certainly good as far as they go, but the reasons ascribed are bad pedagogy.

Great stress has been placed upon the assumed principle that the mind is a sort of homogeneous organ or power which proper gymnastics or grooming can awaken to activity. Through this activity it is supposed to have gained strength, and this strength is further supposed *to be applicable in any direction.* It is assumed that mental power is something perfectly general and may be applied to any specific problem. As Dr. De Garmo has stated the theory (in repudiating it), it assumes "that the mind can store up mechanical force in a few subjects, like grammar and mathematics, which can be used with efficiency in any de-

partment of life." "That is," observes Dr. Hinsdale,[1] "the process that formal discipline assumes may be likened to the passage of energy from the fires of the sun, first to vegetation, and then to the coal beds and subterranean reservoirs of oil and gas, whence it is again drawn forth to cook a breakfast, to warm a drawing-room, to light a city, or to propel a steamship across the ocean."

Prevalence of the Theory of General Discipline.—Although many will admit that elementary school studies are largely those that are needed for practical purposes and for general information, yet when the high school is considered it will not be so readily conceded. The high school and the college are considered chiefly as institutions affording mental discipline and the cultivation of mental power. When I entered the university as a student the distinguished president in his address to new students held that the great aim of education is the acquisition of mental power instead of facts. He stated that he had ranked high in mathematics once, but felt sure he could not then pass a freshman entrance examination in mathematics. He regarded the derived power, however, as a permanent possession which he had turned to account in every mental feat in later life. He was a great man, but he had a faulty psychology. His interpretation of the processes of acquisition, of forgetting, and of mental growth and development was entirely erroneous.

In the schools pupils frequently hear the faulty notions of mental growth and development dinned into their ears. When they inquire concerning the relation of their studies to life they are often put off with the answer that their minds are becoming developed, that the pursuit of the subject is for their good, and that though they will never use the knowledge gained in that subject, the hard work will develop their perception, their memory, their imagination, their reason, etc. Platform speakers at the opening exercises emphasize the thought that if the pupils will only submit patiently to the prescribed exercises,

[1] *Studies in Education*, p. 46.

later in life they will be armored for any sort of mental fray. In their commencement orations the fledglings echo the refrain about the paramount importance of mental discipline, though what they mean by it is still more hazy and undefined in their minds than in the minds of their elders.

Thorndike in discussing the same question says:[1] "It is clear that the common view is that the words accuracy, quickness, discrimination, memory, observation, attention, concentration, judgment, reasoning, etc., stand for some real and elemental abilities which are the same no matter what material they work upon; that these elemental abilities are altered by special disciplines to a large extent; that they retain those alterations when turned to other fields; that thus in a more or less mysterious way learning to do one thing well will make one do better things that in concrete appearance have absolutely no community with it.

"The mind is regarded as a machine of which the different faculties are parts. Experiences being thrown in at one end, perception perceives them, discrimination tells them apart, memory retains them and so on. By training the machine is made to work more quickly, efficiently and economically with all sorts of experiences. Or in a still cruder type of thinking the mind is a storage battery which can be loaded with will-power or intellect or judgment, giving the individual 'a surplus of mind to expend.' General names for a host of individual processes such as judgment, precision, concentration are falsely taken to refer to pieces of mental machinery which we can once for all get into working order, or still worse to amounts of some thing which can be stored up in bank to be drawn on at leisure."

The doctrine of educational gymnastics has gained an alarming hold. Teachers are told that "mental power is a more valuable result of teaching than mere knowledge, and hence the process of acquiring becomes more important than the knowledge acquired. Power abides; facts are forgotten."

[1] *Educational Psychology*, p. 84.

Objections.—The theory has gained most of its support from the fact that many of the best trained minds down to the present have taken certain traditional courses and it is thereby argued that being the best trained and having had certain courses they must have derived their power through those courses. It is forgotten that those scholastic courses have been taken by those individuals because they were the best individuals at the start and therefore became students and continued as such. Modern education is demonstrating that entirely different courses may attract the best individuals, and that these individuals at the close of the pursuit of such courses are still among the best. It is being clearly demonstrated as fallacious to assume that the best individuals are best because of a particular course of study. It is equally fallacious to assume that the wide variety of powers necessary to place an individual among the great or distinguished have all been developed through a narrow range of experiences.

A further fallacy comes from likening the mind to the muscles of the body, which by specific exercise can develop strength that can be utilized in a variety of ways. Even in this physical analogy there is much fallacy. Dr. Hinsdale says: "The force engendered by any defined exertion of physical power is fully available for all like kinds of exercise, but only partially so for unlike kinds. Thus, the power or skill engendered by driving nails can all be used in driving nails, but only partially in shoving a plane. . . . Activity tends, first, to invigorate the whole body—'to tone it up,' as we say—and, secondly, to overflow into new channels lying near to the one in which it was created. . . . The facts do not prove that a reservoir of power can be accumulated by any one kind of effort that can be used indifferently for any and all purposes. There is no such thing as a formal physical discipline. Energy created by activity flowing in one channel cannot be turned at will into any other channel. A boxer is not perforce a fencer. A pugilist in training does not train promiscuously, but according to certain strict methods that experience has approved." [1]

[1] *Studies in Education*, p. 46.

Professor O'Shea writes the following in his very excellent chapter on "Formal Discipline":[1] "The physiological principle upon which the doctrine of formal discipline is based is seen upon examination not to be quite true as it is generally stated. Muscular activity which is concerned with particular employments and undertakings does not beget a power that can be expended without loss in the accomplishment of any task whatsoever. The oarsman cannot turn all the energy he develops in rowing to good account in pitching hay or pulling beans or shoeing a horse or carrying a hod on his shoulder. The pugilist cannot employ without loss in another form of occupation the brawn gained in his training. No particular form of muscular activity, in short, can be made to yield power that can be utilized in other ways without some waste. And why? Because rowing, for example, calls into play in definite combinations muscles and their energizing nerve centres which are not coordinated in precisely this way in any different activity."

Professor Hanus remarks: "Power means ability to do something—to bring about results. The results achieved will always be in some one field of activity, however; and the kind of power developed through the pursuit of a given subject will consequently be usually restricted to power in dealing with data of a particular sort. That is to say, power in physics is different from power in Latin; and these forms of power are different from power in plastic art or pure mathematics, as these last are different from each other. There is no such thing as power in general that can be cultivated through the pursuit of any one subject, and can then be drawn upon at any time for successful achievement in other subjects. That a man shows power first in classics and afterward in mathematics or botany, for example, does not prove that the man's mathematical or scientific ability was developed through the classics. It proves only that the man has both linguistic and mathematical or scientific ability. It does happen, of course, that different subjects like mathematics and physics, or physics and chemistry, or drawing and

[1] *Education as Adjustment*, p. 248.

painting, are closely related; and hence that the data of one subject are often found to some extent in another, and also that the method of one subject can be appropriately applied to another. . . . But, in general, the relations of the subjects will not be close enough to justify the assumption that power may be developed through one subject for use in other subjects." [1]

Observations and Experiments.—We need but to recall the discussions concerning memory, sensory training, apperception, and training in powers of observation to justify our conclusion that the training of psychological powers is comparatively specialized in its effects. For example, the child who has been practised in observing colors is not thereby made more expert in discriminating tones in music, more accurate in spelling, or in arithmetical processes. We hear much fiction concerning the efficiency of certain studies, especially natural science, in training to acuteness of *observation*. It has been taught that training to observe in one field will insure skill in other directions as well. Now, as a matter of fact easily verified by common experience, training in observation is largely special in its effects rather than perfectly general. Training in observing zoological specimens, for example, will not give increased skill in observing music, grammatical niceties, or spring fashions.

But in order to test the matter in a more scientific way than is possible by unsystematic observation of various effects of training a great variety and amount of experimental work has been performed. These experiments have been designed to test the influence of learning one kind of activity upon the acquisition of some different kind of activity. Much of the experimentation has been in the realm of memory. Some of the best has been in the realm of experimental tests in perception or training in power of observation. The best and most exhaustive experimental work in this line has been done under the direction of Dr. Thorndike at Columbia University. Thorndike and Woodworth made a great variety of experiments to discover the influence of training in estimating weights, dis-

[1] *Educational Aims and Educational Values*, p. 8.

tances, and areas upon other subsequent forms of learning. In Thorndike's own words:[1]

"Individuals practiced estimating the areas of rectangles from 10 to 100 sq. cm. in size until a very marked improvement was attained. The improvement in accuracy for areas of the same size but of different shape due to this training was only 44 per cent. as great as that for areas of the same shape and size. For areas of the same shape but from 140 to 300 sq. cm. in size the improvement was 30 per cent. as great. For areas of different shape and from 140 to 400 sq. cm. in size the improvement was 52 per cent. as great.

"Training in estimating weights of from 40 to 120 grams resulted in only 39 per cent. as much improvement in estimating weights from 120 to 1,800 grams. Training in estimating lines from .5 to 1.5 inches long (resulting in a reduction of error to 25 per cent. of the initial amount) resulted in no improvement in the estimation of lines 6 to 12 inches long.

"Training in perceiving words containing *e* and *s* gave a certain amount of improvement in speed and accuracy in that special ability. In the ability to perceive words containing *i* and *t*, *s* and *p*, *c* and *a*, *e* and *r*, *a* and *n*, *l* and *o*, misspelled words and *A's*, there was an improvement in speed of only 39 per cent. as much as in the ability specially trained, and in accuracy of only 25 per cent. as much. Training in perceiving English verbs gave a reduction in time of nearly 21 per cent. and in omission of 70 per cent. The ability to perceive other parts of speech showed a reduction in time of 3 per cent., but an *increase* in omissions of over 100 per cent.

"These experiments showed very clearly the influence of (1) the acquisition during special training of ideas of method of general utility, and also (2) of facility with certain elements that appeared in many other complexes. Instances of (1) are learning in the 10 to 100 cm. training series that one has a tendency to over-estimate all areas and consciously making a discount for this tendency, no matter what the size or shape of the surface

[1] *Educational Psychology*, p. 90 *et seq.*

may be; learning to look especially for the less common letter (*e. g.*, *s* in the case of *e-s* words, *p* in the case of *s-p* words) in the training series and adopting the habit for all similar work; learning to estimate areas in comparison with a mental standard rather than the objective 1 sq. cm., 25 sq. cm., and 100 sq. cm. squares which each experimenter had before him (after one gets mental standards of the areas he judges more accurately if he pays no attention whatever to the objective standards). An instance of (2) is the uniform increase of speed of eye movements in all the perception tests through training in one, an increase often gained at the expense of accuracy.

"In the opinion of the authors these experiments show that:

"Improvement in any single mental function need not improve the ability in functions commonly called by the same name. It may injure it.

"Improvement in any single mental function rarely brings about equal improvement in any other function, no matter how similar, for the working of every mental function-group is conditioned by the nature of the data in each particular case.

"The very slight amount of variation in the nature of the data necessary to affect the efficiency of a function-group makes it fair to infer that no change in the data, however slight, is without effect on the function. The loss in the efficiency of a function trained with certain data, as we pass to data more and more unlike the first, makes it fair to infer that there is always a point where the loss is complete, a point beyond which the influence of the training has not extended. The rapidity of this loss, that is, its amount in the case of data very similar to the data on which the function was trained, makes it fair to infer that this point is nearer than has been supposed.

"The general consideration of the cases of retention or of loss of practice effect seems to make it likely that spread of practice occurs only where identical elements are concerned in the influencing and influenced function."

Dr. Bagley arranged some observations "to determine whether the habit of producing neat papers in arithmetic will function

with reference to neat written work in other studies; the tests were confined to the intermediate grades. The results are most startling in their failure to show the slightest improvement in language and spelling papers, although the improvement in the arithmetic papers was noticeable from the very first." Dr. Bagley further comments upon this by saying: "The very decided trend of all this experimental evidence seems to indicate that the theoretical impossibility of a generalized habit—either 'marginal' or subconscious—is thoroughly substantiated by accurate tests."[1]

Mr. Lewis, of Dartmouth, conducted an investigation in 1902–1903 to discover some of the correlations among the different mental powers and to test specifically whether it is true "that the good reasoners in one subject are the good general reasoners? Or, more specifically, is the good mathematical reasoner the good reasoner in every-day practical affairs, and in law?" He says that of the twenty-four groups of high-school pupils compared in mathematical reasoning and practical reasoning, the five in each group standing highest were selected as conspicuous for their ability in mathematical reasoning. Of the 120 thus distinguished, 63 per cent. were at the foot of the list in the tests of practical reasoning. On the other hand, 47 per cent. of those at the foot of the list, judged by mathematical reasoning, were conspicuous for their position at the head of the list in the practical reasoning tests. As a supplementary test, and one still more convincing, he examined the records from ten college graduating classes of men who had studied mathematics and law, and compared their relative efficiency in the two subjects. Mr. Lewis remarks that "50 per cent. of the best students in law were conspicuous for their poor showing in mathematics; and 42 per cent. of those poorest in law stood at the head of the series in mathematics." His diagram indicates at a glance the striking comparison. The further comment should be quoted: "These tests are surely convincing of one thing, *viz.*, that students able in mathematical reasoning

[1] *The Educative Process*, p. 208.

are not even generally able in practical reasoning and law. And by an allowable inference, persons able in one kind of reasoning are frequently not able in other kinds. But once having established this point, the whole theory of faculties falls to the ground, and with it the stronghold of formal discipline." [1]

Dr. Naomi Norsworthy conducted some experiments upon school-children to test the effects of practice and reached the following conclusions:[2] "It seems probable that certain functions which are of importance in school work, such as quickness in arithmetic, accuracy in spelling, attention to forms, etc., are highly specialized and not secondary results of some general function. That just as there is no such thing as general memory, so there is no such thing as general quickness or accuracy of observation. . . . Accuracy in spelling is independent of accuracy in multiplication, and quickness in arithmetic is not found with quickness in marking misspelled words; ability to pick out the word 'boy' on a printed page is no guarantee that the child will be able to pick out a geometrical form with as great ease and accuracy."

Some experiments have been performed which seem to show that as a result of exercise of one kind some slight gain of power may be derived in other directions. Ebert and Meumann,[3] through a long series of experiments on memory, were led to believe that some definite gain was perceptible in other directions than that secured in the training material. Experiments in exercising with the right hand show that not only the right hand may gain, but that the left hand does also.[4] But Swift distinctly disclaims that such results lend any support to the theory of formal education. He says:[5] "It would be a mistake to suppose that such experiments in cross-education give support to the doctrine of formal discipline. There is no evidence to

[1] "A Study in Formal Discipline," *School Review*, 13 : 289–291.

[2] *New York Teachers' Monographs*, 1902, vol. IV, pp. 96–99.

[3] *Archiv für die Gesamte Psychologie*, vol. IV, 1905.

[4] See Davis, *Yale Studies in Psychology*, vol. VIII; and Swift, *American Journal of Psychology*. vol. XIV.

[5] *Mind in the Making*, p. 190.

show that training has general value. Indeed, it all argues strongly for the influence of content." Coover and Angell believed that through a training in discriminating tones some increase occurred in the discrimination in shades of colors.[1] Judd reports some experiments of his in which judging one kind of lines seemed to have some influence in determining the length of other lines.[2]

But even in the case of gain in one function by activity of another, the explanation of the gain does not reinforce the old theory of formal discipline. Most of the authorities explain the gain as coming from the discovery of better methods of learning; or that the materials learned or the organs involved possess common elements.[3] Angell believes that the gain may be explained in terms of attention and the formation of certain generalized habits of acting. In all exacting work one learns how to shut out distracting factors and in that way to attend better. This is rather negative. Real attention depends upon the content of mind—upon apperception and association. Even Judd,[4] who is one of the strongest exponents of the belief in generalized training, seems to explain the matter in terms of association and the generalization of habits.

Colvin [5] believes that there may be a transference or spread of effects if there are common elements; or if general ideals or attitudes are produced in connection with a given activity. He argues that it is the business of teaching to promote this transference through the establishment of purposive associations. He shows that oftentimes the child is one-sided in development, *e. g.*, a poor visualizer, and therefore a poor reader. This particular power should be connected with the reading process and made more efficient. He says: "In seeking to

[1] *American Journal of Psychology*, vol. XVIII, 1907.

[2] *Educational Review*, June, 1908.

[3] See Pillsbury, *Educational Review*, June, 1908; Fracker, *Psychological Review, Monograph Supplement*, June, 1908; Bennett, *Formal Discipline*.

[4] *Loc. cit.*

[5] "Some Facts in Partial Justification of the So-called Dogma of Formal Discipline," *University of Illinois Bulletin*, October, 1909.

secure transfer, especially where purpose does not play an important part, see to it that the stimulus which is to call forth the desired reaction is such that it may be a common element in many objective situations. If, for example, it is desired to promote in general the habit of observation, it will be unwise to cultivate this habit in a very narrow and unusual field of experience. Habits of observation may doubtless be secured by training the observer to give careful attention to objects appearing under the microscope. This training in observation will on the whole probably have less possibilities of transfer to other fields than observation cultivated in the study of more common objects of life, such as those of plants and animals that are often met with in the daily environment."

In the cultivation of the emotions Colvin urges the establishment of certain general emotional attitudes through many specific acts inspiring the emotions. Is this not the very best kind of anti-formalistic doctrine? The very point which the anti-formalist emphasizes is that without definite attempts the establishment of these associations will probably not be made and if not made there is no transference. The anti-formalist argues for a breadth and variety of experience and the purposive establishment of bonds of association among these experiences. The child easily fails to see the general rule or law in a particular example and after learning the statement of general laws, almost as frequently fails to know which general rule applies to the particular example. My own entire discussion of memory, association, and the conceptual process has sought to emphasize the necessity of generalizing all specific knowledge—transferring the effects. But at the same time it is fully recognized that generalizing and associating do not necessarily take place so that universals are always seen in particulars or particulars in universals. The accomplishment of this is really the large problem of teaching. The uneducated man gets plenty of isolated experiences, but he does not universalize them.

The fact that the practice of a habit until it becomes crystallized renders it difficult to acquire other habits is an argument

showing the isolation and insulation of structures and functions. Fracker has clearly shown that improvement in one direction may definitely hinder improvement in other directions. The cases of prodigies who are so hyper-developed in one or a few powers and so abnormally under-developed in others are good evidence against any doctrine of the general spread of effects.

One of the most significant lines of psychological investigation in throwing light upon the question of general mental development through special training has been the investigation of memory training. The popular mind declares that a child should memorize gems of poetry, proverbs, entire poetic and prose selections, etc., in the perfect belief that his general memory will be strengthened. Never was there a greater fiction. While it is a good thing to memorize gems of poetry, the reason usually assigned is a bad one pedagogically. The quotations should be learned for the sake of the thought and not as memory training. By careful experimentation James and others have shown, and I have confirmed, that long practice in memorizing material of one kind aids memory very little, if any, for totally different things. Even long attention to memorizing of poetic writing does not assist much, if any, in memorizing prose. Still less would the poetry assist in the memory of chemical names and geological specimens. Every one can confirm this in his own experience. Every adult student, according to the popular doctrine, ought to possess a perfect memory for all things. The poor memory has been crammed and exercised on various studies for upward of twenty years, but how many adults remember the names of persons they meet any better than they did in childhood? How many married men have infallible memories for mailing their wives' letters, or purchasing the spool of thread, or can recall the dress that somebody wore at the party, or the decorations of the house, or the setting of the table, the pattern of the glassware, etc.? I suspect that the more the mind has been exercised with Latin roots, antediluvian fossils, amœboid specimens, or mathe-

matical formulæ, the less apt the every-day affairs are to be remembered.

We know that there are many types of memories. One person has a good verbal memory, a second a memory for faces, a third for dates, a fourth has a good memory for facts scientifically arranged but a poor desultory memory, another a memory for musical tones, etc. Now if memory exercise *in general* operated according to the hypothesis of formal discipline should not one's memories for all types be equally good? The fact is we have memories rather than memory. The same line of discussion would be applicable to imaginations. Few people have imaginative powers equally strong in all directions. Still more striking are the examples of specialized development in those with phenomenal memories and imbecile understanding. Again, if the dogma of formal discipline were true, why should not the intellect, the feelings, and the will all be developed equally? As a matter of fact, we know that there is often strikingly unequal development among these powers in the same person. There are, for example, persons of wonderful mental acumen, but cold logicians without a sign of emotionalism. Then there is the enthusiast whose emotions often lead his judgment astray. We even frequently classify individuals and peoples upon the basis of these differences, as choleric, phlegmatic, intellectual, impulsive, explosive, deliberative, etc. With any given power or faculty we may often find great extremes in the same individual. Take the judgment, for example. As Dr. Hinsdale remarks: "No curious observer can fail to notice how practical ability to judge and to reason tends to run in special channels. Eminence in microscopy, in sanitary science, in engineering, in philology, in pedagogy, in a thousand specialized pursuits, is no guaranty of ability in other matters, or even of good sense in the common affairs of life. The only astrologist whom I have ever happened to know personally was an eminent civil engineer." [1]

Oppenheim[2] wrote: "Proficiency in one direction does not necessarily imply an equal proficiency in others, and a bankrupt

[1] *Op. cit.*, p. 52. [2] *The Development of the Child*, p. 92.

in business may be a brilliant success in rearing offspring. . . . A man may be a brilliant mathematician, or a profound philosopher, without necessarily showing a fitting appreciation of the physical and mental needs of his family." Thorndike remarks:[1] "The mental traits involved in the pursuit of a school study are always complex and vary with the different aspects of the subject and the different methods of teaching used. For instance physical geography taught as a science demands different capacities from commercial geography taught as it commonly is. Formal grammar, theme writing, the history of literature, and æsthetic appreciation may all be called 'English,' but they depend upon capacities that have little in common."

Professor Carpenter, in combating the theory of vicarious mental discipline, said:[2] "Men trained almost exclusively in Latin and Greek are quite as likely to write badly as to write well." And Professor Baker wrote in the same book[3] that "discipline in and of itself is of much less efficacy than was formerly supposed. It has been demonstrated that good intellectual habits are not necessarily transferable; that a high degree of accuracy in one line of activity is often found compatible with actual slovenliness in another. In fine, that discipline is valuable in and for the field of work in which it is given, and valueless for anything outside that field. Discipline in reading and writing, then, while it would make good readers and good writers of the pupils, would do nothing else for them."

Adams[4] sets out, in his characteristic way, some of the absurdities of formal training when applied to moral education. He says: "What could call into play more of a boy's faculties than orchard-robbing? Almost all the virtues are trained in the exercise of this vice. The necessary planning demands prudence, forethought, caution. The choosing of the right moment implies careful observation, judicious estimate of character, and intelligent calculation of probabilities. The actual

[1] *Educational Psychology*, p. 35.

[2] Carpenter, Baker, and Scott, *The Teaching of English*, p. 17. [3] P. 78.

[4] *Herbartian Psychology Applied to Education*, p. 111.

expedition demands the greatest courage, firmness, self-control. Climbing the tree and seizing the fruit are only possible as the result of the most accurate adjustment of means to end. All the results aimed at in the most liberal intellectual education are here secured; no teacher is required; and the boy enjoys it. Why does not apple-stealing rank with Latin and mathematics as a mental gymastic?"

Arguments from Variability in Powers.—Were the doctrine of general discipline true there ought to be no variations among our powers. The power gained in one capacity is said to be carried over to all others. All varieties of accomplishment dependent upon a given power ought then to be equally attained. For example, one ought to be as proficient in algebra as in history, as proficient in geometry as in algebra, as good in grammar as in botany, etc. But it needs no demonstration to convince that there are great variations in accomplishment among different subjects by the same individual, and what is more, these varieties in accomplishment often represent fundamental differences in capacity. One may be inclined to natural science and have poor mathematical ability, be a fine linguist and sadly lacking in mathematical reasoning, or skilful in music and poorly equipped for logic and philosophy. Who ever saw many musicians with a philosophical bent of mind? It is even true that a given individual may have rare power in algebraic mathematics, where all depends upon logical trains of thought and power of abstraction, but may be very inefficient in geometric mathematics, where so much depends upon those qualities of visual imagination necessary to a good topographical mind. How many would be willing to be judged mentally for all situations by ability to spell? So generally is inaptitude for spelling recognized that no one jeopardizes his reputation by confessing to being far short in this particular. Probably many cases of poor orthography bespeak carelessness in the matter rather than the lack of ability, but multitudes justly take refuge under the plea of incapacity. It is but necessary to note also the ease with which some children learn to spell. Those

who have to toil at it and then achieve indifferent results are apt to marvel at the celerity of the more favored ones. Thorndike[1] reports a class test in spelling which shows that the best speller had nineteen out of twenty words correct, while the poorest missed all but three. Any teacher in the work could duplicate the list.

Biological Evidence.—One of the most convincing arguments against the theory of formal discipline comes from biology. Exercise of an organ or function tends to produce development of that organ or function. While such exercise may have a general tonic effect upon the rest of the organism, growth and development are largely limited to the parts exercised. Our study of the evolution of the various powers of body and mind showed clearly the effects of stimulations long-continued upon given portions of the organism. We noted, for example, how special forms of activity had changed the muzzle and the feet of the polar bear; how particular modes of life had developed in other animals peculiar claws, teeth, hoofs, hair, eyes, ears, etc.; how changes occur in plants when removed from one environment to another. In all of these it was evident that the application of new stimuli to a given organ or function made its effects manifest almost wholly in that limited portion. In a negative way the withdrawal of a particular stimulus causes atrophy in the special organ. One of the best illustrations of this is in the case of cave animals, whose eyes have atrophied and become rudimentary. The animals as a whole are little affected. Similarly changes in hoofs, fur, legs, fins, teeth, etc., take place with little correlative effect upon other portions of the animal.

The theory of the localization of function and all the facts supporting it are arguments against the theory of formal discipline. Special localized areas and special functions could never have been developed had not the effects of exercise been cumulative at certain points rather than evenly diffused. Nourishment was supplied to the particular parts in excess of that supplied to any other parts. Consequently growth and de-

[1] *Principles of Teaching*, p. 83.

velopment followed in the particular directions. A given portion of the brain controlling a special function may be materially increased in development without much affecting other parts. Certain portions unexercised may atrophy without causing degeneration of other parts. Again, a given area may sometimes be completely excised without seriously affecting the remaining portions. Only in very low unspecialized forms may substitution of other areas take place. If the theory of general powers were true, any portion of the brain ought to be able to take on the function originally controlled by the part destroyed. If the doctrine of general powers were true, it would be inconceivable that localization and specialization should ever have taken place. Any organ ought, according to that theory, to be able to control any function, and an undifferentiated, homogeneous structure would have served equally as well as the exceedingly complex, specialized brain which we possess. With the gradual isolating, insulating, and specializing of functions, however, efficiency has arisen.

On the other hand, biology teaches just as definitely that each organism is a unity and that any influence affecting one structure or function of the organism will have *some* influence upon all other structures and functions of the organism. But there are all degrees of interrelation among the structures and functions of the same unitary organism. Some are exceedingly close, others so remote that two organs are sometimes almost as distinct as if belonging to different individuals. Consequently, if two structures or functions are very intimately related, as the hand and the arm, or logical memory and good judgment, the exercise of the one is certain to influence the other considerably. But if the two are very remotely connected, as the big toe and the ability to appreciate musical tones or colors, the exercise of the one will have little effect upon the other— in many instances so little as to be practically negligible. To take an extreme case of the lack of transfer of pathological effects, the amputation of a foot probably never has any effect upon sight or hearing. Conversely, the effects of the exer-

cise of the eye or the foot have no influence upon each other. While the formal school arts do not show such extreme degrees of remoteness, are there not very great differences in functions and structures involved in acquiring such arts as color work and grammatical syntax, or as rote singing and cube root? Are the differences not so great that the effect of learning one would be of almost infinitesimal aid in learning the other? It is certainly manifest that if we wish to secure improvement in color discrimination or the multiplication table, the process must be mainly direct.

Donaldson[1] wrote: "The avowed aim of certain educational schemes is to produce a rounded, balanced individual as an outcome of the training process, a psychological result comparable with the ideal human form at one time sought in sculpture. Since conditions of life on the globe are not uniform, and since man only approaches the ideal in his development when in harmony with his surroundings, such a universal ideal is as fanciful as was the notion of Goethe concerning the 'Urpflanze'; a sort of grandfather of all the plants possessing the characters of its multiform descendants, yet displaying them with an ancestral simplicity worthy of the golden age of which it had formed a part. As a matter of fact, the education of an individual is a very local problem in its details. The weak points in the central system must be strengthened, that the abilities given by the strong ones may be guided by some sort of balanced judgment. But the balanced and judicial states are, so far as they go, plainly statical, and the vigor of a healthy restlessness is very necessary if there is to be advance. While growth continues, things bodily and mental are lop-sided, for growth is never general, but accentuated, now at one spot, now at another. But this very unbalance, if only it be the outcome of natural endowment and not of *a priori* training, gives a vigor not otherwise to be obtained. The history of the normal individual is through various phases of unstable equilibrium and awkward strength, to the poise and quiescence of late maturity,

[1] *Growth of the Brain*, p. 356

yet in any community examples of all these phases are found as terminal states in both old and young. The formal methods, therefore, which shall recognize, in the presence of these enormous differences in endowment, the dynamic value of the natural inequalities of growth, and utilize them, preferring irregularity to the roundness gained by pruning, will most closely follow that which takes place within the body, and thus prove most effective."

Scientific Conception of Mind.—"The science of education should at once rid itself of its conception of the mind as a sort of machine, different parts of which sense, perceive, discriminate, imagine, remember, conceive, associate, reason about, desire, choose, form habits, attend to. Such a conception was adapted to the uses of writers of books on general method and arguments for formal discipline and barren descriptive psychologies, but such a mind nowhere exists. There is no power of sense discrimination to be delicate or coarse, no capacity for uniformly feeling accurately the physical stimuli of the outside world. There are only the connections between separate sense stimuli and our separate sensations and judgments thereof, some resulting in delicate judgments of difference, some resulting in coarse. There is no memory to hold in a uniformly tight or loose grip the experiences of the past. There are only the particular connections between particular mental events and others, sometimes resulting in great surety of revival, sometimes in little. And so on through the list. Good reasoning power is but a general name for a host of particular capacities and incapacities, the general average of which seems to the namer to be above the general average in other individuals. Modern psychology has sloughed off the faculty psychology in its descriptions and analyses of mental life, but unfortunately reverts customarily to it when dealing with dynamic or functional relationships." [1]

New Conception of Discipline.—Discipline in reality is therefore something very different from the generalized effects which

[1] Thorndike, *Educational Psychology*, p. 29.

it is popularly supposed to be. By a discipline of body we mean that through exercise of function and experience of a given sort a tendency or potentiality for action in that given direction has been produced. The soldier is so trained that upon hearing the auditory stimulus, "Attention!" he immediately assumes a given attitude. "Present arms!" is a stimulus causing immediate muscular responses in arms, hands, etc. A skater is a trained skater when he can execute with facility various muscular movements which he pictures to himself. One is a trained stenographer when upon hearing certain sound symbols the muscles of the hand and arm immediately, unhesitatingly, unerringly fall into desired ways of acting. The more reflex, habitual, and automatic the foregoing movements have become, the better trained, or in other words the better disciplined the individual is in these directions.

Correspondingly the mind when habituated to given ways of functioning is trained or disciplined in those directions. For example, one who can repeat instantaneously and unerringly the multiplication table, can give sight translations, sing by note, or rapidly think out mathematical equations, has his mind trained to function in those ways under given stimuli. The most effective thinking of the most abstract sort is accomplished best when most of the processes are familiar and semi-automatic. The physician is enabled to diagnose disease accurately by merely glancing at the patient or possibly on hearing of a single symptom only because long practice has linked absolutely in his associative processes certain external signs with certain ideas. We marvel when the great financier seems possessed of supernatural powers of prevision and instantaneously tells whether a given investment will be profitable or not. But he does this because his mind has been trained in handling certain data and has become habituated to certain stereotyped forms of mental functioning.

Inasmuch as any physical work, no matter how complex, is made up of simple elements, it also follows that these elements can be woven into manifold new combinations. Whenever a

new activity involves an element already learned that part of the process does not need to be again mastered. However, it must be recognized that not only the element, but also its connections have to be considered. One who has used the arm and hand in a variety of motions, which may be combined in using a brace and bit, a plane, a chisel, or a saw, or in adjusting watches has not therefore mastered carpentry or watch-making. If he has good general control of the hand he already has much capital to draw upon. But if the new process is an absolutely novel one as a whole and also in its elements then what has been learned is of no avail in the new direction.

Similarly with mental operations. Almost any study involves elements that have been mastered in other connections. These elements are immediately serviceable. For example, in beginning the study of percentage it is found that the subject is mainly a combination of old principles and processes with only a slight addition of new ones. Algebra grows right out of the mathematical ideas gained in arithmetic; and calculus is but an extension and recombination of arithmetic, algebra, geometry, and trigonometry. When the ordinary child begins geography, mathematics, Latin, or German he has had several years' experience in reading and writing. He knows the use of letters and symbols, has acquired some knowledge of language classification and rules. He has in fact multitudes of elements as capital upon which he should immediately draw. Thus all studies are in a way related and to that extent the mastery of one helps in the acquisition of others.

But it must not be forgotten that the combination of old, and even perfectly familiar, elements is a difficult matter in itself. Old combinations may even be a hindrance, especially if too fixed. Bad habits of walking, talking, writing, singing, or thinking are harder to modify than new ones are to inculcate. In percentage all one has to do is to apply the knowledge of addition, subtraction, multiplication, division, and fractions. "All?" Yes. But ay, there's the rub. A student said to me once before commencing the study of the science of education:

"Why, all one has to do is to learn psychology and then, just apply it." "Yes," I answered, "that is all you have to do." Before the year was over he discovered that learning to just apply it was a task not inferior in difficulty to anything he had ever undertaken.

It is not here maintained that the pursuit of a given subject can have no value in the study of another subject later pursued. It is claimed that exercise in a given direction produces greater growth of the special powers involved than in any other. Most subjects of instruction have a great many similar elements. As far as they have similar elements they are valuable for each other. The greater the number of identical elements in the two, the greater the value. Physics has a great many points in common with chemistry, geology with zoology, French with Latin, etc. All subjects are related to language and consequently language illuminates them all. But when we select two that are as far apart as typewriting and arithmetic, or as chemistry and Greek art, or as geology and dancing, or card-playing and Chinese, it is certain that the pursuit of one does not put one far ahead in the accomplishment of the other. Would a doctor of philosophy have any advantage over a high-school graduate in learning stenography or music? According to the theory of formal discipline the years of study on thought problems ought to have increased ability in gaining the technique of music and typewriting—but it does not.

Effect of Ideals.—Next in value to the elements of old knowledge which are utilized in learning new things there are certain ideals and attitudes toward work. There are no general faculties of attention, memory, and reason, which attend, memorize, and reason about one thing as well as another by simply "connecting them up." But there are habits of attending to things, of trying to memorize, trying to reason; in short, habits of striving for excellence, which are no mean possession. In fact, oftentimes the ideals of excellence and of application to duty are among the most valuable assets which the school-boy acquires. But he acquires these on the farm, in the store, or in the shop

as well as in the school—frequently better. It depends largely upon the kind of associates he has. The value that we often so erroneously ascribe to a given subject or kind of work is more truthfully a benefit with which our parents, teachers, and associates should be credited. They may inculcate a desirable attitude toward all work which is of immense value in every relation in life.

Correlation of Physical and Mental Effects.—There are some very curious attempts to get one kind of result from an entirely different form of training. Among the latest of these is the assumption that we are teaching morality through art and athletics. I have no word of fault with art or athletics; I believe in both, but we should be satisfied with developing the æsthetic sense through art and strong bodies primarily through physical culture. Were morality a necessary function of art, Greece in her highest development of art would not have been the most corrupt in morals. Were morality a necessary function of physical development we should find among savages many of the highest types of morality. To confirm the view that they are not necessary correlatives we would need only to mention a recent noble writer who was a poor hunchback and a sickly dwarf, and compare his morality with that of his brother, a champion athlete and a cowardly assassin. The former a hero, the latter a violator of nearly every command in the decalogue. The greatest hero on the foot-ball field *may* be the first to quail on facing an audience, he *may* be one of the first to cheat in an examination, or to commit a crime. Should he sin his physical culture is not the cause. Athletics and honesty are not in any way necessarily related. I heard a foot-ball enthusiast argue at the National Educational Association that foot-ball develops those qualities which make men *always co-operate* in every enterprise. Now, he could equally well have said that in foot-ball the spirit of cornering the markets and forming coal trusts is developed. Foot-ball is a game of co-operation—for each side—but how about altruism toward the opponents? All of the arguments here criticised are absolutely inapplicable.

The Relation Between Knowledge and Power.—The phrase mental power has been very inaccurately used in pedagogics. It is continually discussed from the platform and in the columns of educational magazines in a very indefinite and very erroneous way. In the discussions the term knowledge is usually coupled with it and is apologetically if not contemptuously referred to when compared with the term power. The term knowledge generally fares badly, is made to represent something apparently despicable, and is entirely outclassed by the term power. "Mere knowledge" is the current phrase which is made to do duty in exalting power and in minifying the significance of the possession of knowledge.

The truth of the old adage that "knowledge is power" seems to be sadly discredited by many who love to discourse in glittering generalities. But are the two terms mutually exclusive and incompatible or should the adage be raised into a higher significance than ever before? Power, in physics, for example, means the ability to act or the capability of producing an effect, the capacity of undergoing or suffering change. It also means susceptibility of acting or of being acted upon. Now power may be regarded as latent or inherent or as that which is put forth or exerted. That is, power is either active or passive. According to Sir William Hamilton: "Power is, therefore, a word which we may use both in an active and passive signification; and in psychology we may apply it both to the active faculty and to the passive capacity of the mind." And again he says: "*Power*, then, is active and passive; faculty is active *power* or capacity; capacity is passive *power*."

The passive or, perhaps better, the latent or potential aspect seems to have been largely lost sight of by writers on pedagogy. Let us again examine the various kinds of power which are the necessary antecedents of mental power and also examine the various phases of mental power. The individual begins life with the ability to receive sense impressions of the objective world about him. This is power—the power to receive impressions. It is partly physical, partly physiological, partly

psychical; in the earliest days largely physical and physiological. That is, his sense organs are so constructed as to admit of being acted upon by certain physical or chemical forces, and his nervous mechanism is so developed that the stimuli send currents of nervous energy to the brain cortex. If these stimuli are experienced as sensations or as perceptions there is manifested mental power. Preceding the reception of the sensation there must have been *passive or latent power* of sensation and in experiencing the sensation or perception there was manifested the active power. All animals (and some say plants) possess the mere sensitivity to impressions. This power is mainly physiological, but the interpretation of the data gained is psychical. Even as soon as there is consciousness of the data furnished by physical and physiological processes there is psychic life. It probably antedates even that. Now, this simplest and most elemental power is hereditary. And the higher the organism in the scale of life the greater the initial passive power. This signifies that through the multiplication of ancestral experiences in receiving impressions the potential capacity for receiving impressions has been increased for posterity. Thus far our investigation leads us to the conclusion that passive power for receiving impressions of the external world has been directly modified and produced by receiving those impressions, *i. e.*, by getting knowledge. This permits us to say, at least, that knowledge gained produces power. Guyau said of power[1] that "It is a pre-established constitutional adaptation, an aptitude ready to be awakened and translated into actions. . . . Power is therefore nothing but a kind of residuum left by past actions and reactions."

Next let us investigate the meaning of knowledge. According to Webster, knowledge is that which is known, that which is preserved by knowing, or that familiarity which is gained by actual experience. He also says that it is practical skill, as, for example, a knowledge of seamanship. From the science of neurology we know that whenever any stimulus acts upon a

[1] *Education and Heredity*, p. 47.

sense-organ a wave of nervous impulse is transmitted to some central part of the nervous system and there it effects a change in the structure of the nervous tissue. Every psychosis has its corresponding neurosis. From the physiological side this modified neural structure represents the knowledge obtained and retained. Upon the recurrence of a similar stimulus a similar neural change will take place which is interpreted by the mind as a similar sensation or perception. From the psychical side we know not how nor in what form experiences are stored, in fact we do not believe they are stored at all, but that all mental experiences perish in the process of being experienced. What recurs is a new combination of processes, similar to, yet different from, any preceding ones. But the psycho-physiological basis is well established. The neural modifications are retained ready to be reawakened by proper stimuli. We may speak of the ideas existing in the mind in this potential state without being called upon to explain how or in what form they are retained. The mind simply has the power, the possibility, and the tendency of working again the same way under conditions similar to those which determined the first existence of given experiences. Now, these physiological modifications and the corresponding mental modifications were produced by the acquisition of knowledge. Thus there is the acquisition of power, at least the power of reproducing and re-experiencing the same or similar states of consciousness. If we turn to the doctrine of apperception we also find substantiation of the view that the acquisition of knowledge gives power which determines the character of future acquisitions. The statement that new knowledge is interpreted in the light of that which is already in the mind indicates that knowledge gives us not only the power of reproduction of previous knowledge, *i. e.*, the power of memory, but also determines the power of acquisition. When apperception is defined from the physiological view-point these arguments receive reinforcement. We recall that an apperception is a perception whose character is determined not by the nature of the thing perceived but by the peculiar tendencies of the

nervous system. Since the mind has been modified and has developed power through the acquisition of knowledge or in establishing relations among items of knowledge, it seems clear that one way at least of increasing power is through the acquisition of knowledge.

The conception of various powers in the abstract must be relegated to the limbo of outgrown notions along with the doctrine of "faculties" in the abstract. A faculty considered as an active characteristic is simply the sum total of experiences of a given class, while viewed from the passive stand-point —that of possibilities or power—it represents the existing complex modifications resulting from the summation of all the previous experiences. Hence we may assert that in order to cultivate and increase power we should not concern ourselves with the cultivation of power in the abstract and in general, but with the cultivation of some specific power. To illustrate, we have demonstrated that the culture of the memory in a given direction does not improve the memory in a wholly different direction. Without doubt, wherever there are common elements involved and common processes pursued in memorizing quite different facts there may be some gain. But it is very questionable whether practice in learning poetry will aid in remembering columns of figures, sets of nonsense syllables, or the names of chemical compounds. Whatever has once been committed to memory, although to all intents and purposes entirely forgotten, may be learned more easily the second time. This demonstrates the assumption that the acquisition of knowledge, though the facts are forgotten, leaves as a residuum a certain potentiality or power which may be turned to account in the acquisition of the same or similar knowledge. The doctrine of apperception, as has been shown, teaches that knowledge once acquired aids in the interpretation of all new knowledge, *i. e.*, aids in comparing, discriminating, identifying, judging, generalizing, reasoning about the new facts. Thus the acquisition of given facts has increased the power of memorizing the same kinds of facts; it has increased the habits of com-

paring, discriminating, methods of reasoning, and has increased the power of judging and generalizing with reference to similar classes of facts. Aside from the critical attitudes and habits of mind engendered it has not changed the power of judging or reasoning about other entirely separate classes of facts. For example, practice in forming judgments concerning minerals will probably aid little in judging in a law court.

One writer says: "If my mind were a tablet, and with a sponge I should erase every fact learned in school and college, and not directly applied in the arts there acquired, I should not be very poor; but were I to lose the mental power gained by the mastery of these facts, so many of which were long since forgotten, I should be poor indeed." Such reasoning is very fallacious and even pernicious in its effects. The assumption that power and knowledge are in no way vitally related has led to the undervaluation of knowledge and even to a contempt—especially by those who have limited amounts of it. This doctrine is preached to students and they are led to believe that power will in some mysterious way come to them and thus a contempt for learning is gained. While I am not exalting erudition at the expense of real knowledge and wisdom, yet I would maintain that facts are basal. Before relations among facts can be established, *i. e.*, before reason and judgment can have sway, there must be facts among which to establish relations.

The fallacy of the foregoing quotation rests upon the assumption that knowledge might be lost and power retained. Whenever we receive a fact, from the physiological side certain neural tracts are modified. If the fact is dwelt on long enough to make a definite impression the modification becomes a permanent part of the nervous structure. The modification, it is true, may itself be modified by later impressions, but the brain can never return to its original condition. Facts are just as truly retained as received. Knowledge is no less really retained than is power. The brain is different in potentiality for having received any impression. So the mind as a whole, after receiving any impression, is different from what it was before

receiving the stimulus. We may not be able to recall the given fact in the same way that it was received, but new ideas will all be different because of every preceding fact acquired. The mind at any given time is the resultant of all the forces that have acted upon it. These forces consist of heredity, environment, and the individual's own self-activity. We view the world through glasses colored by all the experiences of both ourselves and our ancestors.

It is not to be maintained that the acquisition or collection of isolated facts will give the highest sort of power. The higher powers of comparison, discrimination, and judgment come from the establishment of relations among the elemental facts. But since all power is special, the higher types of power, it must be conceded, are dependent upon the lower.

Probably feeling and will are in their last analysis as independent as intellectual states, yet each of these phases of mentality is influenced by and dependent upon knowledge. The higher sentiments and the higher volitional states are manifestly the outgrowth of the education of intellectual states. Inquire into the evolution of the appreciation of classic music or the strong will impelling one to lay down his life for the right and it will be seen readily that the feelings and the will have not developed independently. Of course the effects of exercise and habit are not overlooked, but intelligent direction only has been able to produce the habits. Thus we have shown that every phase of power can be traced for its elemental phases to the effects of knowing—and knowing is dependent upon facts. From the foregoing we should learn not to despise facts. The idea of "learning to do by doing" must be complemented by that of "learning to do by knowing." We should not despise facts, for it is through the acquisition of facts that power has evolved. Should we wish to increase intellectual power, one of the basal things to do would be to secure knowledge, either elemental or relational. Even if we wish to increase affective or volitional power, the best and only way is to base the growth of these phases of mentality upon intelligent knowing.

Importance of Content of Study.—The doctrine which maintains that power is gained through exercise alone and that powers are entirely general rather than largely special, must logically maintain that it makes little difference as to what kind of fact is assimilated if only we keep up the mental gymnastics. I hold that it does make much difference what kind of knowledge is gained. To hold the contrary is to imperil the whole theory of moral growth. It makes all the difference in the world what knowledge our boys and girls receive. Their feelings are aroused by knowledge and their activities often determined directly by the facts they learn.

Even from the side of the intellect it makes much difference. Were mental gymnastics the only requisite of intellectual growth, we might separate a child from his fellows, set him to playing checkers or chess, or learning Russian or Choctaw, and then he would be fitted for society, be capable of judging of human actions as well as though he had come in contact with objective facts dealing with society and human activities.

Subjects Should Appeal as Worth While.—Why should subjects be studied if not for the intellectual gymnastics? We may ask a similar question about physical work. We can easily find good and sufficient reasons for doing physical and intellectual work without appealing to the theory of formal discipline. The work should be worth doing. If not it should be left undone. The worthfulness of the ends secured through labor have been the dominating motives of all human work. No one normally goes through a treadmill existence for the sake of doing the treading. In adult life one does not do intellectual work for the sake of the exercise. When we plan buildings, lay out our political campaigns, develop war policies, or write books, we do not do so for the sake of the practice. The ends must appeal to us as being worth while in themselves. It may be that in executing a given kind of work we develop added power for similar kinds of work, but even that kind of motive would not keep us long at our task. The end to be accomplished must be the magnet which draws us irresistibly on.

The case is similar with children's activities. Normally they engage in all sorts of exercises for the sake of the end. Play has been defined as exercise which is careless of the ends to be secured. This is a false interpretation. Play not ruled by entrancing ends to be accomplished ceases to be play. True, when ends are accomplished new objects are at once conceived as worthful and new plays engaged in. But play in which the end does not lure the child on, becomes, like too much of his arithmetic and writing, mere drudgery. In these the objects are not understood or appreciated and hence are distasteful.

The implication intended is that subjects should be studied because they are intrinsically valuable; because the possession of a knowledge of them is distinctly worth while. One of the highest arts of the pedagogue is to make the pupil see and appreciate these values and consequently to be so attracted by the acquisition that he is unsatisfied without them. Too much work is done without this attractiveness and consequently the work is mere drudgery and worth little when compared with that done under the white heat of interest. The boy should study arithmetic, not because he is to gain mental muscle for the practice of law or politics, but because the arithmetic is an indispensable thing for him to know. He ought to be led to appreciate this, and can be under skilful guidance. He ought to study Latin because the Latin has intrinsic value. Grammar ought to be studied not for the gymnastics afforded, but for the sake of the grammar. If the disciplinarian's propositions were true then the kind of arithmetic and grammar would be immaterial. The most antiquated cases in arithmetic, and the most obsolete grammatical forms would serve just as well as modern subject-matter. The elimination of archaic cases of "tare and trett," "alligation medial," the dropping of antiquated number forms and the substitution of modern, down-to-date terms would be a bootless task if the theory of formal discipline were true. The text-books on geography, arithmetic, and grammar of our grandfathers would do just as well as those containing more modern information if gymnastics were all that is required.

The formalist is apt to say that discipline for power is the object of all study, that the facts learned are forgotten anyway, that it makes little difference what one studies provided only that he studies hard (and pursues the formalist's favorite studies!).

President David Starr Jordan, in his cogent article upon "The High School of the Twentieth Century,"[1] makes the following timely remarks: "There is needed in high-school and other educational practice a scientific examination of what is meant by 'mental discipline.' Much of our educational practice at present rests on the tacit theory that when the child is obliged to exert himself strenuously in a limited field, he thereby acquires power in all fields. For generations it has been believed that the pupil who drilled on Euclid had his 'reasoning powers' so developed that they would be serviceable in any field demanding reasoning. So Latin is justified largely because it encourages linguistic and other forms of exactness. This doctrine, which underlies so much of the traditional curriculum of the high-school and early college years, *has so little support from common-sense and psychology*[2] that the coming administration of the high school will be obliged to examine it very critically. In view of the uncertainty last mentioned, many educators are inclining to believe that the best material for the high-school curriculum is that which makes a direct appeal to the pupil as being worth while, and which is taken by the pupil because it is felt to be worth while."

Purpose of the Course of Study.—A critical consideration of formal discipline leads to some very important conclusions concerning the purposes and arrangement of a course of study. (1) Education is a process of adjustment of the individual and the race to varying situations to secure their highest welfare. (2) Particular adjustments demand particular experiences which cannot be furnished by any sort of general gymnastics. (3) Therefore, each type of adjustment must be secured through special appropriate forms of experience. (4) As life is so com-

[1] *School Review*, 12 : 547.

[2] Italics mine.

plex, a great range of experiences is demanded to fortify the individual for his multiform situations. (5) The curriculum should represent prevised or preparatory experiences as well as permanent life experiences and hence must be varied. If limited in scope it denies experiences necessary for the varied development of each individual, and also fails to provide equally for all. (6) It is necessary to bear in mind that the education of the human race which produced the high degree of development which it now possesses was nearly all secured before schools and formal studies were invented or arranged. (7) Racial education was nearly all gained through intensely practical and utilitarian means. Brain development and sharp wits were secured through the primal arts of maintaining existence, providing food, shelter, and raiment, securing pleasure, guarding against pain, and providing for the perpetuation of the species. (8) In our scheme of education we must not forget the basal primitive means of culture. Schools and the formal school arts are not absolutely necessary. We are told that the educated Greek of the Homeric period frequently did not know how to read and write. It was sufficient that the ignorant slaves possessed these almost superfluous accessories. (9) My meaning is now, I trust, clearly apparent. All school arts should be developed out of life's pursuits and in turn contribute to the better accomplishment of these activities. This is, I believe, precisely what Dewey means by urging the conception that education is life and life is education. Any arrangement of school curricula which fails to recognize these fundamental relations will fail to attract individuals and will fail to gain community support. The community and the individuals composing it—pupils in school included—seek first the satisfaction of the primal instincts. The boy who demands to know what use geometry will be is obeying the laws of nature no less than the falling ball obeys the law of gravitation.

According to the extreme interpretation of the doctrine of formal discipline, it would make little difference as to the content of the curriculum. All studies would be of equal value

if equally difficult. Difficulties, drill, and drudgery seem to be the only qualities desired. The subject is regarded as a sort of mental grindstone upon which the wits of learners are to be sharpened; and the harder, flintier, and more disagreeable it can be made the more efficient instrument it is supposed to prove. The boy is told, when objecting that he has no taste for a subject, that it is the very one for him to take. Anything in which he has an interest must be shunned as the plague.

But, in truth, if the emotions, for example, are to be properly developed the mind must be occupied with ideas which arouse the emotions. How can the emotion of patriotism be aroused except through ideas which deal with fidelity, loyalty, and the necessity of the fraternal spirit? How can sympathy be awakened without knowledge of the feelings of joy, sorrow, sadness, despondency, etc.? These can only be gained by witnessing them in others and experiencing them ourselves. No purely intellectual consideration alone can bring into life the deepest emotions. Emotional experience is an absolute condition of development. Arithmetic will not do it, geometry will not do it, linguistic drill fails, manual training fails, all fail except that which touches the germinal life of the emotions and adds to their potentialities. Darwin tells us that his later life was full of regret that he had no interest in music and art. The æsthetic failed completely to find response in him. He ascribes as a cause the excessive devotion through a long life to purely intellectual pursuits. His mind had become unsymmetrical by the hyperactivity in certain directions and the absence of exercise in others.

We rightly say that ethical growth and culture are the highest ends of education. But in practice we ignore all laws for the attainment of these ends by centring the main current of the child's school life upon purely intellectual activities. We profess to be deeply concerned lest the child wander from the paths of rectitude, but instead of pre-empting his mind with high ideals such as could be gathered from literature and history we cause him to spend most of his school life in learning rules of

mathematics and language and acquiring some degree of dexterity in handling their forms and formulæ. Now, arithmetic touches a great many rules, but nowhere in it could I ever discover the "Golden Rule." No, the only way in which one could learn to do unto others as he would be done by is by associating with others and learning the meaning of altruism. This can be done partly through the living contact and partly through subjects which deal with similar situations. If moral growth is to be secured, instruction must have a moral content and the child must be exercised in dealing with situations involving moral activities, and in a higher stage his moral judgment must be appealed to.

If we wish to secure development in any direction, specific exercise and nourishment must be secured in that direction. If many-sided development is to be produced, manifold exercise and nourishment must enter into the course of education. To stint in any direction is to dwarf growth in that particular, to overemphasize in a given direction is to produce abnormality or arrest of development. Excessive culture of physical powers and disregard for the intellectual and moral growth produces the brute; excessive intellectual culture alone develops the logician; while excessive cultivation of the emotions without due balance in other qualities produces sickly sentimentalism with blind, ungovernable passion.

Prejudices Through Doctrine of Innate Ideas.—I believe that much energy has been misapplied in education because of the fallacious notion regarding the nature of mind. So long as the old doctrine of innate ideas is held in any form (though disguised so as to be hardly recognizable) a wrong view of education must ensue. According to that theory the mind is preformed with all its possibilities foreordained and the business of any educator, says Socrates and so says the Middle-Age philosopher, is to draw forth by exercise, by gymnastics to develop these ideas and bring them to maturity. In physical development the same theory was acted upon. Exercise, the trainers said, is the *sine qua non* for physical development. The strength is there, it

needs only training to make it manifest. While partly true, still another indispensable factor is only just beginning to be recognized. The modern trainer not only provides gymnastics, but a training table as well. The general disciplinarians simply added the unwarranted idea that not only is strength gained by the exercise, but it becomes perfectly diffused or generalized.

Corrective Through Doctrine of Apperception.—Now, the mind also grows by what it feeds on. The mind is a functional product of all its past experiences. It cannot exercise on nothing. It is only exercised when dealing with facts. It grows only as experiences accumulate. To chew sole leather would furnish exercise, but little nutriment. Mental gymnastics upon valueless material is equally inane.

The apperception theory of the mind, first formulated by Herbart, changes the whole point of view of instruction and education. According to this theory the mind can grow in a given direction, only through experience received in that direction. Vague and general gymnastics cannot develop the mind because it can only lay hold of those new experiences for which former experiences have fitted it. According to this theory, we cannot develop the sight without seeing, the hearing without hearing, the emotions without feeling. The subject-matter then becomes of great moment. It must have desirable content, and not be mere form; must nourish, not merely discipline. To teach a boy to think he must have something to think about. No formal logic can ever make a thinker. The mind must have facts to compare.

Dr. Dewey wrote: "No number of object-lessons, got up *as* object-lessons for the sake of giving information, can afford even the shadow of a substitute for acquaintance with the plants and animals of the farm and garden, acquired through actual living among them and caring for them. No training of sense-organs in school, introduced for the sake of training, can begin to compete with the alertness and fulness of sense-life that comes through daily intimacy and interest in familiar occupations. Verbal memory can be trained in committing

tasks, a certain discipline of the reasoning powers can be acquired through lessons in science and mathematics; but, after all, this is somewhat remote and shadowy compared with the training of attention and of judgment that is acquired in having to do things with a real motive behind and a real outcome ahead." [1]

Dr. Albion W. Small wrote:[2] "Sociology has no tolerance, however, for the pedantry that persists in carpentering together educational courses out of subjects which are supposed to exercise, first, the perceptive faculty, then the memory, then the language faculty, then the logical faculty, etc., etc., etc. On the contrary, every represented contact of a person with a portion of reality sooner or later calls into exercise every mental power of that person, probably in a more rational order and proportion than can be produced by an artificial process. Our business as teachers is primarily, therefore, not to train particular mental powers, but to select points of contact between learning minds and the reality that is to be learned. The mind's own autonomy will look out for the appropriate series of subjective mental processes." Hall wrote:[3] "Although pedagogues make vast claims for the moralizing effect of schooling, I cannot find a single criminologist who is satisfied with the modern school, while most bring the severest indictments against it for the blind and ignorant assumption that the three R's or any merely intellectual training can moralize."

Angell says: "It should, however, be remarked that, strictly speaking, there is probably no such thing as a purely disciplinary study. Any study is likely to be robbed of its good name and labelled a formal discipline, if somebody chances to allege that it is good for something beside that for which it obviously exists. The implication of our deliberations would be that every study has latent in it the possibilities of becoming to some extent a formal or general discipline. Its pursuit may effect intellectual changes not confined to the topic with which it is

[1] Dewey, *The School and Society*, p. 24.
[2] *Proc. N. E. A.*, p. 177.
[3] *Adolescence*, I, p. 407.

ostensibly engaged. Meantime, it seems to be a safe and conservative corollary of this doctrine that no study should have a place in the curriculum for which this general disciplinary characteristic is the chief recommendation. Such advantage can probably be gotten in some degree from every study and the intrinsic values of each study afford at present a far safer criterion of educational worth than any which we can derive from the theory of formal discipline."[1]

What Subjects Develop Most Thought.—Those subjects develop the mind most which stimulate the most thinking. Now which of the subjects occupy the pupil's thoughts when not actually required to prepare his lessons? It seems to me there can be but one answer. Those which deal with things and human activities. What subjects deal with these? Plainly literature, history, economics, sociology, science. The Chicago *Record-Herald* showed upon investigation that in almost every public library boys were seeking books on electricity. Great stacks of history and literature find their way without compulsion into the boys' and girls' hands.

The boys and girls in the high schools are just ready to grapple with many of these important problems which occupy the theatre of action about them. Listen to their debates. What do they choose for topics? How, I ask, shall we fit them to form intelligent opinions about strikes, the tariff, Cuban reciprocity, Philippine independence, the city taxes, municipal boodlers, government ownership, etc.? Kaiser Wilhelm said they must train up young Germans, not young Romans. Similarly it is incumbent upon any nation to train its growing boys and girls through the problems of current life and through those forms of culture which enable them to interpret the present. That which is historical in literature, language, or science may have a very vital influence, but only when its relation to the present becomes apparent.

Our boys and girls of to-day are to be in the midst of the world's affairs to-morrow, and still in view of this there are those who

[1] Angell, *Educational Review*, June, 1908.

would designedly shut them off from the world, busy them with expressions of thought absolutely remote from present-day interests, make them learn forms and formulæ which the majority will never use directly or indirectly; all in the hope, well meant, that they will thus learn to think. The only way to learn to think is to deal with fundamental concepts which are felt to be worth while. If we merely wish to give something hard, why not give them Russian or chess?

Arrangement of the Curriculum.—In view of the foregoing may we not conclude that the different studies should be arranged so that the traditional subjects shall receive no more attention than others, except from those pupils who intend to specialize? The course might well include some Latin for all; possibly a year or two, and more for those who specialize. It certainly ought to include some modern language, as that is a means of gaining touch with present-day civilization, affords as much so-called discipline as the classics, and is very apt to be of direct value. English should be accorded its rightful place, not as a parsing exercise—we spend years too much time on that sort of profitless work now—but English which leads the student into all the best thoughts of all times. The youth should become saturated with the greatest literature, and through the ideas assimilated his entire life should receive bias and direction. The sciences should be included in every course for every student—not enough to be specialized, but enough to open up the whole vista of possibilities. History should be accorded more than the stingy place now given it. All should be given introductory courses in algebra and geometry, but two years in the high school should be ample. Is it not inconsistent when we plead for all-round culture and then shut the youth up through more than half his school days with nothing but words, words, words? The narrowest sort of specialization! The one who studies natural science three or four years is dubbed a narrow specialist, while the one who studies dead languages twice as long is said to be gaining all-round training and laying a broad foundation!

Then, lastly, there should be added to the groups one which we may term the social group. In it would be included civics, something of political economy, social facts and forces, ethics, if possible a little psychology, and a consideration of educational questions. I do not mean the pedagogy of teaching arithmetic, but such questions as school taxes, the relation of the school to the state, its value to society, the significance of early education in forming correct habits, the value of co-operative educational factors, etc. In the university, according to real needs, I believe we should require of all the language and literature of the mother tongue, some foreign language and literature, history, economics, sociology, several sciences (including physiology), philosophy, ethics, psychology, and education. These are the ones that help most in producing an adjustment to environment. Abundant opportunity should be given to every one to take any other subjects of human value as electives. The range of electives offered should be wide and the instruction afforded should be exhaustive.

Relation Between Utility and Culture.—We must break down the false notion of the absolute difference between that which is of utility and that which affords culture. In an ideal education they will be identical. Any study is cultural and highly educative which gives power (knowledge), puts one in touch with and in sympathy with civilization; makes one open-minded, gives one breadth of interests, makes one interesting and likable, refined, and useful to society. True culture means developed intellect and refined feelings; deals with morality as well as with things intellectual. Dr. Draper says that one may obtain culture from Latin and Greek, also from building bridges. Those subjects then, it would seem to me, afford most culture which come nearest to life's interests. It is the business of the school to help the pupil find those interests. No study in the course has a right to a place for its formal discipline alone. Who would crack nuts for the exercise in cracking them? The facts themselves should be of sufficient value to justify their contemplation. The old doctrine of educational gymnastics

must give way to the new one of nurture. The mind grows by what it feeds on, as well as through exercise.

All development in nature has come about because exercise and nourishment in a given direction have produced development in that direction. Hence if we would develop the pupil physically he must have physical exercise and food; if he is to be developed mentally he must have mental food and exercise; if he is to be developed morally he must have moral nutrition, *i. e.*, knowledge of things moral, and be exercised in the performance of moral acts. If the pupil's social nature is to be developed, there is but one way, and that is by placing him in a social environment. The one who pores over his grammar and his mathematics, and excludes himself from society, will grow up anti-social. Now, all school life from the kindergarten through the university should have for one purpose the discovery of aptitudes and interests, and the developing of the same. These interests should be many-sided. Since growth is special, breadth of interests, largeness of view, and judicial-mindedness can only come by touching life at many points. Poring over one's grammar, valuable as it may be, will not develop one's social nature, one's political interests, will not enlarge one's views of men and events. These can only be gained through nourishment secured from knowledge along these lines. The college student who becomes a recluse starves his nature in some of the more important directions. He becomes narrow and contracted and unable to sympathize with society. Equally undesirable is it for the student to spend all his time in society of the present and never know the great truths which books may reveal to him. The student may say, "I study men, not books." This is sound, if rightly interpreted, but he should understand that there are some men besides freshmen well worth knowing.[1]

Many-Sidedness of Interest.—I plead for the cultivation of breadth of interests and the connecting of formal school work

[1] See Bolton's "Ethical Aspects of Mental Economy," *Pop. Sci. Mo.*, 71 : 246–257.

with life's interests. "But," says some one, "many interests are utilitarian." Granted; but utilitarian does not necessarily mean mercenary. By utilitarian, I mean that which can be utilized in connection with life's pursuits and interests. Sir Wm. Hamilton says a utilitarian is "Simply one who prefers the useful to the useless; and who does not?" The poet studies the flowers, the changing tints of the rainbow, the birds of the air, the hills and vales, and then bursts forth into song utilizing the stores of images he has gathered. The engineer, the architect, the inventor, the railway superintendent, the landscape artist, the business promoter, all utilize stores of imagery in developing their various plans. Shall we not hold their works in as high esteem as those of the poet, the philosopher, the statesman, or the classicist? A sanitary engineer purifies a city and makes possible the development of vigorous bodies, which in turn provide conditions for sound mental life. These together promote cheerfulness and higher ideals. Is his not as high an order of service to humanity as that of one who writes verses, paints pictures, or echoes a foreign tongue or two? The one who designs a beautiful, commodious, and hygienic structure certainly displays as much mental power as one who teaches history, Latin, or philosophy within it. His contribution to the elevation of society also may be equally great. In developing architectural skill he has secured soul expansion not less than the classicist. To be sure they are of different types, but society progresses only with differentiation and specialization.[1]

The public high schools and colleges should ever remain true centres of liberal culture, but that does not mean that they should assume that only a certain few protected subjects are cultural. The liberality comes from the breadth of interests stimulated, the development of a scientific spirit and an openness of mind. The method which pervades is more indicative of liberality and culture than the program of studies. We may teach dead languages, but the teacher and the method need

[1] See Bolton's "Facts and Fictions Concerning Educational Values," *School Review*, 12 : 170–188.

not be dead. On the other hand, biology may be taught after a method that stifles expansive spiritual growth. Great abiding interests, breadth of view, and richness of social service are marks of culture; adherence to tradition, contracted vision, and selfishness of action are marks of pedantry. Melville B. Anderson wrote: "The way to educate a man is to set him to work; the way to get him to work is to interest him; the way to interest him is to vitalize his task by relating it to some form of reality." President Eliot said in his address on "The New Definition of a Cultivated Man" that a cultivated man should possess not all knowledge, but that "which will enable him, with his individual personal qualities, to deal best and sympathize best with nature and with other human beings."

Supreme Importance of Great Teachers.—Finally, and of greatest importance as educative factors, are the personality and influence of the living men and women who are in the environment of the youth. We are too apt to regard education like a manufactory. So many units of Latin, mathematics, and history put into the hopper we assume will give us back an educated being. But no matter how well proportioned the mixture may have been, unless the great truths and worthy ideals have been transformed into spiritual forces, all is unavailing. Civic ideals and moral virtues may have been rehearsed, but only when they have quickened dormant possibilities into abundant life have they been to any worthy degree educative. Now, great, inspiring, living teachers can do infinitely more than the mere pursuit of a subject toward the determination of what shall take root. Next, and perhaps not even second in importance, is the influence of companions. Some one has said with great truth that we send our boy to the school-master to be educated, but the school-boys educate him. They largely determine a youth's interests, and almost entirely his actions. And after all, actions count most. We will with all we have willed, and every act is the beginning of a habit that becomes a life-long phantom tyrant.

Hence, although every subject may contribute to will-power,

the direction in which that power will be applied is absolutely determined by the great interests and passions which may happen to lay hold of the youth's life. So the course of study, the paper curriculum, which every new principal "revises" is a secondary matter. The all-important thing is to have great souls which breathe out abundant life, inspiring and invigorating all with whom they come in contact.

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